

MARKETDATA ENTERPRISES

A Full-Service Industrial Research Company

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THE MARKET FOR ELECTRONIC SWITCHES

A MARKETING, ECONOMIC, FINANCIAL, AND
TECHNOLOGICAL ANALYSIS

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321

THE ELECTRONIC SWITCHES MARKET

TABLE OF CONTENTS

	<u>PAGE</u>
<u>INTRODUCTION & MAJOR TYPES OF SWITCHES</u>	1
<u>OVERVIEW AND EXECUTIVE SUMMARY</u>	6
<u>THE MARKET FOR ELECTRONIC SWITCHES</u>	
* Summary & Analysis, Forecasts	13
* Mfrs.' Shipments of Switches (Total Market), 1964-84 Actual Sales, 1986-Estimated, 1990 Forecasts	18
* Switches Sales Relative To "All Electronic Components" Sales, 1972-86 Forecast	19
* Product Line Mix: Percent of Total Market By: Toggle, Slide, Rotary Selector, Pushbutton, Snap-Action, Thumbwheel, Miscell. (1976-1990 Forecast)	20
* Sales of Switches By Type (1976-1990 Forecasts):	
- Toggle (Incl. miniature & subminiature)	21
- Slide (Incl. rocker, miniature, subminiature)	21
- Rotary Selector (Incl. lever, jog lever, miniature)	22
- Keyboard	22
- Pushbutton	23
- Snap-Action	23
- Thumbwheel	23
- Miscellaneous Types	23
<u>MARKET SALES FORECASTS & COMPUTER ABSTRACTS</u>	
* Summary & Introduction	24
* 1985 Sales, By Type Switch, To OEM Sectors	26
* Forecasted Sales Growth By Type Switch	27
* Consumption By Type Switch (1984-89)	28
* Computer Abstracts of Sales Forecasts By Various Trade Journals & Industry Analysts (Dialog/Predicasts Database Abstracts, 1984-89)--97 Abstracts	29
<u>COMPANY MARKET SHARE ESTIMATES</u>	
* Summary & Analysis	41
* Estimated Share of Market For The Top 5, 10, 15, 20 Companies and All Others (Sales, Percent of Total Mkt.)	42

TABLE OF CONTENTS (CONTINUED)

	<u>PAGE</u>
<u>MAJOR END-USE SECTORS: PERFORMANCE & DEMAND</u>	
* The Military Market-Discussion & Analysis	44
* The Commercial Equipment Market	
- Computers/Data Processing Mfrs.	45
- Communications Equipment Mfrs.	46
- Instrumentation Mfrs.	47
* The Industrial Electronics Market	48
* The Consumer Electronics Market	48
* Statistical Tables, 1984-86 Sales By Detailed Breakdown	
- Summary Table-All Above Sectors	50
- Data Processing Equipment, By Kind	51
- Communication Equipment, By Kind	52
- Industrial Electronic Equipment, By Kind	53
- Consumer Electronic Equipment, By Kind, Factory Sales To Dealers (units, dollars)	54
- List of Major Dept. of Defense Programs, Value-1986-88	58
<u>THE PRICE SITUATION</u>	
* Summary & Discussion	61
* Trends in Producer Price Indexes (Bureau of Labor Statistics), 1983-Sept. 1986, All Switches, Rotary, Keyboard, Push- Button, Other	62
<u>THE EXPORT MARKET</u>	
* Summary & Analysis	63
* Switches Exports (Value) As % U.S. Sales (1980-86 Est.)	65
* Exports of Switches By Kind (Snap-Action, Pushbutton, Rotary), Value 1980-86 Est.	66
* Exports Product Mix: Percent of Total Exports By Type Switch (1980-86 Est.)	67
* Exports By Type Switch, By Country of Destination (1985)	68
<u>IMPORT COMPETITION</u>	
* Summary & Analysis	69
* U.S. Imports of Switches, Total & By Kind, 1981-85, As % Domestic Sales	70
* Imports By Type Switch, By Country of Origin ((1985)	71

TABLE OF CONTENTS (CONTINUED)

SWITCH COMPANY PROFILES

PAGE

(Descriptions of Company Product Line/Market Involvement
5-Year Financial Summaries, Etc.):

* AMP, Inc.	72
* AUGAT, Inc.	73
* CTS Corp.	74
* Cherry Corp.	75
* HUBBELL, Inc.	76
* M/A-COM, Inc.	77
* MICROSWITCH (Div. Honeywell)	78
* MOLEX, Inc.	79
* OAK INDUSTRIES	80
* SQUARE D CO.	81

DIRECTORY OF SWITCH SUPPLIERS

(Alphabetical Listing of 310+ Companies, Addresses-Classified
by Type Switch Supplied)

82

INTRODUCTION

Marketdata has compiled this report by utilizing a combination of: the most up-to-date Government statistics and market research reports available, various private sector computerized databases, directories, trade journals, and original research, analyses and forecasts. We have attempted to collect only the most pertinent electronic switch market information.

The report has been designed to give the manufacturer, market consultant or industry analyst a comprehensive yet cost-effective means of learning about the past, current and projected status of the electronic switch marketplace in the United States.

Marketdata examines market recessions and growth periods alike, product mix, changing technology, selected foreign market/export opportunities, U.S. and foreign competitors, estimated share of market for the industry leaders, and the nature of demand from various end-user markets. It is **Marketdata's** intent is to expose the reader to a **variety** of information sources and viewpoints, in order to present a **consensus** analysis of the market, rather than a one-sided opinion.

Marketdata recognizes that any **one** source of information alone usually does not provide a thorough and truly accurate view of a particular market or industry. One organization may be consistently over-optimistic in its forecasts, while another consistently underestimates it. For that reason, **Marketdata** has utilized a combination of Government and private sector sources, which together will comprise a better and more comprehensive database to use in planning, forecasting and decision-making. Significant differences will exist in how each source views the market.

The following sources have been utilized for this report.....

Government Publications:

* Annual editions of the Department of Commerce publication Current Industrial Report MA 36N--Selected Electronic and Associated Products (SIC code 3679).

Introduction (continued)

- * Department of Defense
- * Annual Survey of Manufactures
- * Exports by Commodity, By Country of Destination
(Annual editions, FT 410)
- * Bureau of Labor Statistics

Private Sector Information Sources:

- * Predicasts Lockheed/Dialog Computer Database
- * Magazines and Trade Journals: Electronics, Electronic News, Electronic Business, Electronic Design Gold Book--and these journals' editorial staffs

- * Dun & Bradstreet directory
- * Standard & Poors directories, stock sheets, Electronics

Industry Surveys

- * Moody's Investors Service, stock sheets
- * Value Line Investment Survey
- * Asian Electrical & Electronics Trade Directory
- * Electronic Industries Association
- * Switch company 10K Financial Statements, Annual Reports

MAJOR SWITCH TYPES

APPLIANCE SWITCHES

Appliance switches are low-cost devices for use where actuation is not abusive. Typical uses are on vending machines, toasters, vacuum cleaners, washers, garbage disposals, television sets, and automobile dashboards. Although the basic steps for selecting and applying appliance switches are similar to those for commercial switches, there are two major differences.

Reliability of the switching function in an appliance is not as critical as cost. A switch failure on a commercial switch could mean the loss of an important communication link, the destruction of a missile, or costly delay in a data-processing operation. Failure of a switch on an appliance means, at the very worst, an inconvenience to the user until repairs can be made.

The second major difference is that appliance switches are customized to give a certain image or appearance to the appliance. The appliance-switch market is filled with a wide variety of customized controls, each with a unique appearance and application.

COMMERCIAL SWITCHES

Commercial switches generally are designed for an office-type environment. These switches usually are not sealed to resist entry of liquids. Actuating means should be the operator's hand rather than a tool. Typical uses are on computers, laboratory equipment, office machines, communications equipment, aircraft, and military field and shipboard equipment.

Electronic equipment often requires switching of low-energy current in the millivolt, milliampere range (dry circuits). Special types of switches, generally of subminiature size, have been developed for such use. Special contact materials and designs are used to minimize and stabilize contact resistance for extended and reliable life.

INDUSTRIAL SWITCHES

Industrial switches are used to actuate magnetic contractors or other remote-operated controllers which handle power circuits. These switches, which are pilot devices, must be ruggedly constructed to withstand operator and mechanical abuse. They are frequently exposed to oil, coolants, chemicals, and dust. And relatively heavy electrical loads must be switched by the contacts due to high inrush current drawn by the ac electromagnets of the controllers.

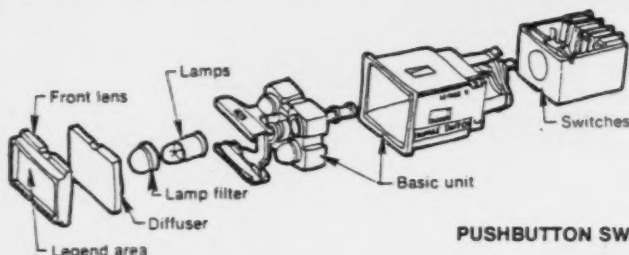
Various types available include illuminated pushbuttons, push-pull operators, rotary selectors, and selector-push switches. They are generally available in five basic types: standard-duty, heavy-duty oiltight, miniature oiltight, and multi-light-control oiltight.

SNAP-ACTING SWITCHES

A precision snap-acting switch is a small switch with closely spaced contacts that are snapped together or apart by a spring mechanism operating within the same close limits all the time. The switch must operate consistently upon application of the force moving through the same distance. Applications for precision snap-acting switches range from simple door switches to the highly critical control of vital functions in military and aerospace equipment.

Major switch types

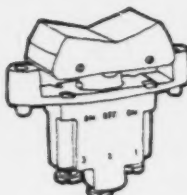
Pushbutton switches are actuated by a direct thrust in line with the button travel, and are available with momentary, maintained, or sequential switching action. A modification of the maintained pushbutton action is a pull-to-operate switch. Pushbutton switches may have either legend plates or lighted displays for identification. The latter may also serve as an indicator of switch condition. Two methods of providing lighted display are used: 1. A pushbutton and a separate pilot or indicator light. 2. A pushbutton and light combined into a lighted pushbutton.



PUSHBUTTON SWITCH

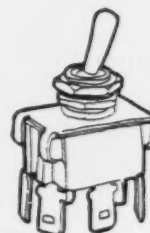
Used generally as a styling feature, the rocker toggle button bridges the gap between the pushbutton, with its ease of actuation, and the toggle switch with its positive indication.

In illuminated switches, light from an edge-lighted panel is directed into half of the rocker button to provide a lighted indication of position. A code, legend, or name is often engraved into the rocker button for switch-station identification.



ROCKER-BUTTON SWITCH

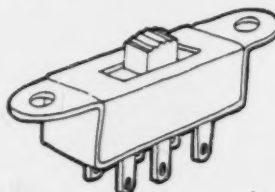
Toggle switches generally have two types of action—momentary and maintained—and are usually available with two or three operating positions. A two-position toggle typically has these positions at equal angles on each side of the axial centerline of the mounting bushing. A three-position toggle has two extreme positions plus a center position. The center position is generally for the *off* condition, with the two extreme positions representing on conditions. Magnetically-held toggle switches for remote-release operation have an internal coil that replaces mechanical holding mechanisms. In a memory toggle switch, one contact is left energized when the lever returns by spring action to the center position. As a safety feature, a special pull-to-unlock lever is available which requires the operator to pull the lever before it can be moved. This arrangement prevents accidental actuation.



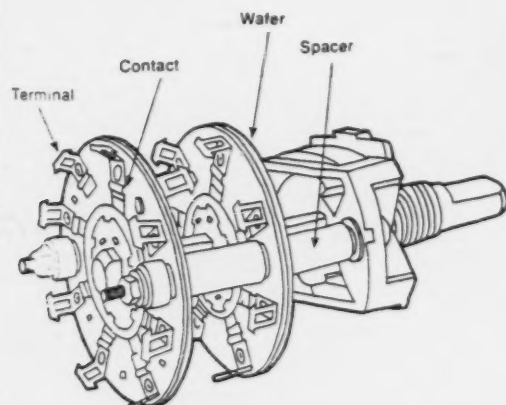
TOGGLE SWITCH

Slide switches commonly have two or three positions, but up to six stations are available. Switch action may be either momentary or maintained, with or without detents. The tendency to overshoot the center position of a three-position action from an outboard position requires heavy detenting.

SLIDE SWITCH

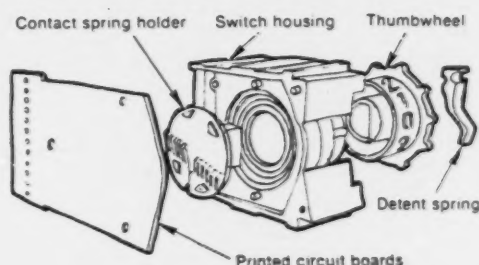


Rotary switches are generally available with either momentary or maintained actions. Rotation can be either unlimited (turned through more than one complete circle) or limited to 360 degree after which the direction of rotation of the knob must be reversed. A rotary switch may have many points of actuation, or as few as two positions (a simple on-off switch). When positional differences are as small as 10 degree, a large dial or a long knob should be used for adequate indication of switch position. More common angular differences between positions are 30, 45, or 90 degree. Momentary rotary action is usually limited to two or three positions. Maintained rotary action can be provided for several positions throughout the 360 degree rotational stroke. Maintained actions are usually combined with a positive detent force to give good tactile feedback.



ROTARY SWITCH

Thumbwheel switches are rotary types in which the switch-wafer axis is parallel to the control panel. Like rotaries, switch terminals may be mounted in a circular array for direct wiring to external circuits, or switch wafers may be printed-circuit cards with pin terminals for soldering to PC boards. The switch body may be open or enclosed in both rotary and thumbwheel switches. The movable contact may be actuated by thumbwheel, lever, rocker, or buttons.



THUMBWHEEL SWITCH

The United States market for Electronic Switches, which traditionally has accounted for 1.32% of all electronic components sales, is currently in the middle of the fourth slow-growth period since the mid 1960s. Switch producers will have to be especially careful, flexible and adaptive in order to survive in this highly competitive current and future environment.

More than 310 companies compete for a bigger share of what Marketdata estimates is a \$601 million market, at the manufacturer or producer level in 1986. The market is estimated to have reached this level from actual sales of \$536 million in 1984, and is forecast to grow only 5.5% yearly between 1986 and 1990, reaching \$733 million in the latter year.

Following are estimated 1986 sales and shares of the total switch market by the various product line segments.....

Toggle Switches	19.6% of market	\$117.8 Million
Slide "	15.8	94.9
Rotary Selector "	15.0	86.3
Push-Button "	11.0	66.1
Keyboard "	9.1	54.7
Snap-Action &		
Thumbwheel	2.0	12.0
Miscell. Types	27.5	165.3

Like many other component markets, the electronic switch market is characterized by a dynamic variety of market forces, both domestic and foreign, internal and external to the company, that shapes the future of competitors' health. Following are the major trends that have developed.....

- 1) The market is extremely competitive, with a large number of producers fighting for a larger share of a stagnant, low-growth market.
- 2) Basic "commodity" or standard switch technology is being challenged increasingly by digital technology, rendering older, mature products such as rotary, toggle, and rocker switches obsolete in more and more applications.
- 3) Producers are attempting to automate more and are shifting production overseas in order to cut costs.

4) Several switch producers recently attempted to integrate themselves into the **KEYBOARDS** market, diversifying out of their traditional market focus, but faced extreme price pressures, low margins, and stiff Japanese competition. Therefore, some firms have abandoned this market and returned back to switches only.

5) Price pressures remain substantial in nearly all areas.

6) Producers are increasingly emphasizing **custom** switches and seeking to carve out specialized niche markets as a survival strategy.

Switches are used in a wide variety of applications, with industry trade journals estimating the following shares of OEM consumption:

Industrial Equipment Mfrs.....	consume 41% of switch production
Military and Space Equipment Mfrs.....	30
Commercial Equipment Mfrs.....	21
Consumer Equipment Mfrs.....	7

Switches are incorporated into such equipment as:

process control systems	robots	machine tools
computer printers, keyboards	word processing equipment	
CRTs, data terminals	point-of-sale terminals	
typewriters	answering machines, telephones	
copiers	facsimile machines	PBHs
home appliances	compact disc players	TVs
audio equipment	telecommunications equipment	UCRs
scientific instruments	medical instruments	test instruments
measuring & control devices	automatic teller machines	

Marketdata has identified 313 companies active in the U.S. switch market, with roughly 30 or so capturing the lion's share of sales. The main players include the following.....

Microswitch (div. Honeywell)	Stackpole
Cherry Corp.	Allen-Bradley
Hubbell, Inc.	Switchcraft
Oak Industries	Crouse-Hinds
CTS Corp.	Rugat
ITT Schadow	EECO
Standard Grigsby	Centralab (No. American Phillips)

OVERVIEW (Continued)

- 8 -

Grayhill
Amp
Molex
Omron (Japanese)
Cutler-Hammer

Arrow-Hart
Potter & Brumfield (AMF)
Alps Electric (Japanese)
Carlingswitch

Marketdata estimates that Microswitch is the market leader, with an estimated 10.5% of the total market and sales of \$79 million. Bugat is number two with 7.1% and an estimated \$53 million. Molex is third with an estimated 5.7% and \$43 million, followed by CTS Corp. with 5.3% and \$40 million, and Oak Industries with 4.7% and an estimated \$35 million. The Top 5 firms are estimated to capture 33.3% of the market, the Top 10--52.2%, the Top 15--62.7%, and the Top 20--69.5%. Foreign companies capture an estimated \$120 million or 15.9% of the market. For a more detailed market share analysis, refer to that section of the report.

Equipment makers (switch end-users) continue to move away from electromechanical switches and toward digitized inputs. As one example, airlines and aircraft makers are eliminating standard switches such as rotaries, toggles, and rockers in favor of keypads. Future designs will absorb most switching circuits into integrated and automated airborne systems favoring digital signal processing, with more control of the plane programmed into computers.

The switches selected for use in current designs are hybrid switch-and-indicator-light assemblies which give the status of the switch at each actuation. According to Boeing, utilization of switches fell substantially with the introduction of the B-757 and B-767 several years ago. The same is continuing with designs for the Boeing 737-300 due for service in 1989, and in the new plane tentatively named Boeing 7J7, set for introduction in 1992.

According to United Airlines: "Conventional toggle and rotary switches have stabilized in a flat mode for several past design cycles. It appears now that such switches will remain fairly dormant in the future. Keypads, however, are right at the center of a substantial amount of innovative activity and should show a higher proportion of use from now on...a need is developing for small displays such as miniature CRTs, LEDs, or LCDs to operate in conjunction with keypad switches...". At TWA, the word is that switches are being programmed out of the design picture for future commercial airliners. The aim is for a simpler cockpit, equipped with fewer but larger CRT displays.

This changing technology picture is a "catch-22" situation for switch makers, especially small firms. New products are needed to stimulate market growth, but a flat market makes it difficult to introduce new products. If sales are flat, companies will not have the funds to invest in R & D. Many engineering and research managers see the pace of technology quickening in semiconductors but lagging in the rest of the electronics industry--like the switch market. In addition, the revised tax code should dampen capital spending and perhaps the overall economy. Electronics industry leaders feel that help for *small* companies, tax-loss carry-forwards, and special aid for startup firms was left out as well.

Automation, in an effort to cut costs, is of paramount importance. Market leader **Microswitch** invested heavily in order to retain market position and shift to a lowest-cost producer.

They are not alone, as **EECO** will make more switches in a new Mexican facility, whereas before this work was contracted out. **Grayhill**, a major DIP switch maker, installed a great deal of automatic equipment during 1984. At **Carlingswitch** today, 20% of its lines are automated (versus none two years ago).

In the "commodity" or standard switch lines, competition is heaviest from the Japanese, and is where U.S. firms are moving production overseas and automating most. The Japanese may have to raise prices on switches sold to the U.S. due to the devaluation of the dollar in recent months--giving U.S. makers a slight reprieve. Companies with a large part of their business in **rotary** switches are somewhat better off, because a large percentage of rotary sales go to military markets, which are strong. Secondly, even non-military rotaries are heavily customized for industrial users, making across-the-board competition less likely. **Oak Industries** is therefore at a competitive advantage, being the leading rotary switch supplier. It is one of the few companies still making all their products in the U.S., but also relies more heavily on automation to compete.

Automation, of course, favors companies with large volume production runs and substantial market share. On ~~low~~ volume, it is not feasible to automate--you need to use other means, such as moving production offshore.

Diversifying into the **keyboard** business has not proven fruitful for many switch makers, since a slump in the computer market and

competition from Asian firms has caused a major shakeout. **AMP** and **Stackpole** abandoned the business and **Cherry Corp.** decided to move completely offshore. Even the U.S. leader **Keytronic** was reportedly talking to Japan's **Minebea**, parent of **NMB** and **Hi-Tek**, about a possible joint venture. **Stackpole** stopped keyboard production during early 1986. **AMP Keyboard Technologies** decided to get out of the full-travel membrane keyboard business. And, **Cherry** moved full-travel keyboard production out of its **Waukegan, IL** plant, shifting it to a wholly-owned subsidiary in **Auerbach, West Germany**.

Sales by Far East keyboard firms in the U.S. have risen sharply, with a flood of imports from **Taiwan** and stepped-up efforts by Japanese firms such as **NMB** and **Alps**. Taiwanese firms have geared up for massive production of low-cost **IBM PC "clones"**. **Alps** makes all of **Apple Computer's** keyboards and mice at the **Garden Grove, CA** facility.

Eventually, there will will probably be another shakeout, leaving only a few domestic suppliers, with the biggest competitors overseas. Following are 1985 estimates of the shares of the U.S. merchant keyboard market, by company, according to **Electronic News**.....

Key Tronic	35% of total market (\$325 million)
Micro Switch	15
NMB Hi-Tek	6
Cortron	6
Cherry	5
Other Far East	13
Other U.S.	20

Price competition is extensive in the U.S. switch market, a necessary evil in order to gain the sale in a flat market environment. Based on data from the Bureau of Labor Statistics, **Marketdata** estimates that producer prices of switches overall will rise only 1.4% during 1986--and this may be optimistic. In light of market conditions, plus foreign competition, this situation is not likely to change soon.

As for the trade situation, U.S. switch manufacturers as a group run a slight "balance of trade surplus", with exports outpacing imports \$87.5 million to \$85.2 million as of 1985. This was down from a \$13 million surplus the prior year. **EXPORTS** now seen to have levelled off at the \$85 million plateau, estimated to be worth 13.8% of domestic

sales, or \$83 million in 1986. Snap-Action switches are exported more heavily (54% of total value), compared to 22% each for Push-Button and Rotary types. Most U.S. exports go to Canada, Japan and Western Europe.

Commerce Dept. statistics reveal that **IMPORTS** represented 15.3% of domestic sales during 1985, worth \$85.2 million. Snap-Action devices accounted for 45% of the total, followed by Push-Button switches with 43% and Rotary types with 11%. Japan and Mexico are the nations exporting the most switches to the U.S., although a substantial amount of the Mexican figure is probably really "re-exports", or devices sent there by U.S. firms for assembly--not competition from Mexican switch makers. In 1985, Japan accounted for 31% of the value of rotary switch imports, 32% of push-button, and 18% of snap-action. Mexico accounted for 67% of snap-action switch imports. The remainder of imports came from Western Europe, Malaysia, and Taiwan.

FUTURE OUTLOOK AND MANAGEMENT RECOMMENDATIONS

There is no doubt that the future for American switch manufacturers will be difficult and challenging. Indeed, there are major forces at work to constrain growth in this mature market of electromechanical devices. However, switch producers seem willing to cling to their traditional switch market and "tough it out". If that is the strategy the switch manufacturer seeks to follow, there are a few positives on the horizon that **Marketdata** sees.

The dollar is, and has been through the Fall of 1986, declining in value compared to Japanese and European currencies, giving U.S. producers a slight reprieve in terms of price competitiveness.

Military markets should remain strong through the balance of the 1980s.

In the commercial airline sector, where electromechanical switches are being designed out, ~~new~~ markets may open up in the LED/LCD indicator/switch assembly packages area.

Custom devices/applications and specialized niches will always be available for the resourceful producer to build a reputation in.

Investment in R & D and automation is still alive in the switch market, and has been successful in cutting costs and making U.S. producers more competitive vis-a-vis overseas firms.

Switch producers may have gotten a break toward the end of 1986 with tax reform-induced end-of-year buying of big ticket items such as autos and home computers, as consumers scrambled to take advantage of sales tax deductions being eliminated--but this will not happen again next year.

All in all, switch producers probably have learned from the experiences of those that ventured into the keyboards business, and will operate leaner and more efficiently than ever before, shifting production overseas, automating more, choosing carefully those new products to be developed, and allocating their resources to the best potential return on investment areas. However, further mergers and consolidations are likely in the future, and those small firms with limited capital and who are unwilling to adapt to the new environment will undoubtedly be in serious trouble.

MARKET SUMMARY

Marketdata estimates that the market for mechanical switches for electronic circuitry at the U.S. *producer* level will reach \$601 million by year-end 1986. This represents growth of 12% over the 1984-86 period, much slower than the expansions of 1977-79 and 1982-83. Furthermore, we forecast sales to advance at the very moderate rate of 5.5% per year from 1986-1990, reaching \$733 million. The switch manufacturer is now in the midst of a stagnant and mature market characterized by intense competition, both domestic and foreign, changing technical requirements by electronic equipment end-users, the temptation to diversify into other product areas such as keyboards, and the challenge to develop new applications and products in order to sustain future growth.

Switches were among the few products spared during the 1985 recession in passive components. Selling prices remained fairly stable and there was brisk demand from military and Government users. The components business overall inched up 2% in 1985, with manufacturers looking forward to a better 1986. An improvement does seem to have taken place, but growth will still be a modest 6% gain. The trend for the year was a slow first half and a pick-up in second half activity. Computer and automotive markets should have gained steam in the second half, spurred by low-interest rate car-buying incentives in the Fall, and traditional year-end price cuts in the low end of the computer market (personal computers, small business systems).

MARKET SEGMENTS-PRODUCT LINE MIX

During 1984, the most recent year that *actual* product line sales data was available from the Commerce Department, **TOGGLE** switches accounted for the biggest segment of the market with 20.1% or \$107.9 million. **ROTARY SELECTOR** types accounted for 16.1% and \$86.3 million, followed by **SLIDE** switches at 15.2% and \$81.7 million, **PUSH-BUTTON** switches at 9.3% and \$49.9 million, **KEYBOARD** switches at 9.1% and \$48.9 million, and **SNAP-ACTION** and **THUMBWHEEL** switches combined at 2.5% and \$13.2 million. A "catch-all" category encompassing all other types of switches labeled "**OTHER MISCELLANEOUS TYPES**" accounted for a substantial 27.3% of the total market, worth \$146.5 million. This class undoubtedly covers such devices as solid state, knife, coaxial, dual-in-line and other types.

TOGGLE switches accounted for an average of 19.3% of the total switch market from 1980-84, and are estimated to have taken 19.6% in 1986. **Marketdata** estimates toggle switch sales to reach \$117.8 million in 1986 (9.1% growth from 1984-86) and \$146.6 million by 1990 (6.1% average yearly).

ROTARY SELECTOR switches accounted for an average of 14% of the market from 1980-84, and are estimated to have taken 15% in 1986. **Marketdata** estimates rotary selector switch sales to reach \$90.1 million in 1986 (4.4% growth 1984-86) and \$102.6 million by 1990 (3.5% average yearly).

SLIDE switches accounted for an average of 15.2% of the market from 1980-84, and are estimated to have taken 15.8% in 1986. Electronics magazine estimated that slide switch sales outpaced the overall market with 14.3% growth over this two year period. **Marketdata** estimates slide switch sales to reach \$95 million in 1986 (16.2% growth 1984-86) and \$110 million by 1990 (4% average yearly).

PUSH-BUTTON switches accounted for an average of 10.6% of the market from 1980-84, and are estimated to have taken 11% in 1986. In fact, Electronics magazine, in its annual forecast issue, estimated that push-button devices were the fastest-growing product line from 1984-86--growing in excess of 24%. **Marketdata** estimates that push-button switch sales will reach \$66 million in 1986 (32.4% growth 1984-86) and \$88 million by 1990 (8.3% average yearly).

KEYBOARD switches accounted for an average of 4.8% of the market from 1980-84, and are estimated to have taken 9.1% in 1986. **Marketdata** estimates keyboard switch sales to reach \$54.7 million in 1986 (11.9% growth 1984-86) and \$84.3 million by 1990 (13.5% average yearly).

SNAP-ACTION & THUMBWHEEL switches, whose sales are combined by the Department of Commerce, accounted for an average of 3.7% of the market from 1980-84, and are estimated to have taken only 2% in 1986. Electronics estimated that these were included in the no-growth or negative-growth areas during 1984-86, with thumbwheel switch sales *falling* by 8.3%. **Marketdata** estimates these switches' sales to reach \$12 million in 1986 (-9.3% growth 1984-86) and \$13.2 million by 1990 (2.5% average yearly).

THE MARKET (Continued)

"MISCELLANEOUS" switches accounted for an average of 32.5% of the market, almost one-third, from 1980-84, and are estimated to have taken 27.5% in 1986. **Marketdata** estimates these sales to reach \$165.3 million in 1986 (12.9% growth 1984-86) and \$188.3 million by 1990 (3.5% average yearly).

NEW TECHNOLOGIES & COMPANY STRATEGIES

Even the very modest growth of the switch market over the past few years would not have been possible if it were not for suppliers' efforts to miniaturize, environmentalize, and digitize what is a mature and basic product. One hurdle in the minds of industry executives is the difficulty of making sure a product is mature, reliable and compatible with existing systems. There is always the problem of bringing a product to market when the market itself is sluggish.

Electronic News states that: "Rather than diversifying, however, most suppliers believe their salvation lies in continuing to serve this market with products that can be made at lower cost and are more custom-oriented. The ultimate aim of these suppliers is to gain a larger share of what is admittedly a fairly stagnant market."

Some suppliers have increased involvement in the **keyboard** area in order to decrease dependence on a flat basic switch market. Some have accomplished this by applying their switch technology to other products such as sensors. **Microswitch**, the market leader, is heading in that direction, but the majority of firms have not chosen this path yet. **Cherry Corp.** will concentrate on improving its subminiature models, especially those used in automotive applications. **ITW Switches** is determined to become a larger supplier of basic switches, establishing one of the broadest product lines anywhere.

Standard-Grigsby, a leading rotary switch producer, has been developing new products in increasing numbers in recent years, believing that only by taking advantage of subtle market shifts can a company hope to survive. This firm was recently moving into **surface-mountable switches**, and shrinking rotary switches to a T0-5 size. Fully 95% of surface-mounted passive components used in the U.S. in 1985 were capacitors and resistors, however. Most firms

that produce other passive components, such as switches, are reluctant to invest in SMD packages and associated tooling until the industry works out broad-based standardization. **Carlingswitch**, a maker of rocker switches, puts heavy emphasis on custom orders, citing that 75% of its business is non-standard, custom switches. The firm claims to be completely vertically integrated, giving it control from raw materials to finished product (with consequent better control over costs and deliveries).

ITT Schodow, engaged primarily in producing pushbutton and key switches, feels that... "You have to design new switches today that meet a number of new requirements simultaneously if you want to outpace the growth of the market." A Japanese competitor, **Omron**, claims that the introduction of new products is the reason for its constant growth in the U.S.

EECO, a switch company supplying medical equipment, peripherals, and telecommunications markets, sees the membrane area as affording the highest growth potential, although it still views opportunities in internally-coded PWB switches and eventually in surface-mountable devices. EECO is not alone in this area related to keyboards--**Cherry Corp.** offers electromechanical, capacitive and full-travel membrane keyboards. Cherry sells a lot of keyboards and keyswitches in Europe and the Far East, a decided advantage over other competitors.

Microswitch was to have added keyboard production capacity in 1985 in Tokyo and Scotland, where these plants previously made only basic switches. Another firm expanding keyboard production is **Mi-Tek** (acquired by NMB of Japan in 1983). **Key Tronic** is nearly exclusively into the capacitive keyboard technology, though it does make some keyboards also. **Stackpole** makes all its keyboards in Taiwan and Mexico. The Taiwan facility serves the Far East market, including the many U.S. equipment companies that moved there in recent years. Stackpole feels that one has to be able to produce at low cost to cope with continuing pressure on prices, and has moved offshore to do it, as have other producers.

Molex is also in the membrane keyboard business, and states that.... "Membrane keyboards are more affected by the business level of printers than the personal computer, and by other business machines and computer peripheral equipment".

Rubber conductive keyboard technology has not gotten off the ground with industry engineers and purchasing managers at personal computer firms that have evaluated it as a low-cost alternative to traditional capacitance switching and metal contact techniques. It is primarily a problem of unproven reliability. Most keyboard suppliers are not mass producing rubber conductive keyboards. Therefore, economies of scale related to cost have not been realized. In addition, the touch of traditional full-travel keyboards is not fully imitated, and the technology is not suited for serious desktop/business applications.

Hybrid DIP Switches have been gaining in popularity, a device first created by CTS Corporation. Hybridization involves incorporating other electronic components into a switch, such as when CTS introduced a DIP switch containing a resistor element. The telecommunications market has provided the greatest demand, but other areas such as test & measurement, computers/peripherals, and instrumentation are beginning to offer opportunities.

Switch producers seem to have the hybrid DIP switch market to themselves currently, since other passive component manufacturers would prefer to supply their products to switch makers rather than try to force entry into the mature and capital-intensive DIP switch area, which is also extremely competitive. Electronic News estimated the total DIP switch market at \$50 million in 1985, with it doubtful that the hybrid portion accounted for more than 20%. The major competitors in this area at this time were: CTS, Grayhill, and Alcoswitch (div. of Augat). Hybrid DIP switches offer several advantages to OEMs--mainly that of board density.

Making hybrids involves slightly higher material costs (than making the DIP switch and a component separately). But, it usually is more than offset by savings in labor, stocking charges and real estate. As an example of broadened applications, a hybrid DIP switch with a resistor element can be geared for at least three functions: an attenuator, a resistor pull-up, and as a terminator used in disk drives. There is also the potential for marrying other components, such as diodes and capacitor arrays, with the DIP switch.

MANUFACTURERS' SHIPMENTS OF SWITCHES
(Mechanical Type For Electronic Circuitry)
COAXIAL, TAP, ROTARY, WAFER, SLIDE SELECTOR, ETC.
 (Thousands)

	<u>Value of Shipments</u>	<u>Annual % Change</u>	<u>No. of Firms Reporting Shipments</u>
1964	\$44,138	17.3	--
1965	53,137	20.4	--
1966	62,061	16.8	25
1967	61,641	-0.7	27
1968	59,278	-3.8	22
1969	58,452	-5.2	21
1970	48,452	-17.1	20
1971	55,165	21.4	23
1972	84,764	53.6	28
1973	122,522	44.5	26
1974	131,706	7.5	36
1975	111,289	-15.5	33
1976	118,117	6.1	NA
1977	181,887	54	59
1978	224,071	23.2	102
1979	366,157	63.4	NA
1980	367,414	0.3	NA
1981	377,188	2.7	NA
1982	446,087	18.3	NA
1983	511,987	14.8	50
1984	536,313	4.7	49
<u>Estimate</u>			
1986	601,000	6.0 (avg. annual)	--
<u>Forecast</u>			
1990	733,000	5.5 (avg. annual)	--

NA- Data Not Available

SOURCE: U.S. DEPT. OF COMMERCE, CURRENT INDUSTRIAL REPORTS
MARKETDATA ESTIMATES, FORECASTS, CALCULATIONS

SWITCHES SALES RELATIVE TO ALL ELECTRONIC COMPONENTS SECTOR

	<u>ELECTRONIC COMPONENTS & ACCESSORIES</u> (Million \$)	<u>SWITCHES SALES AS %ALL ELECTRONIC COMPON.</u> (Percent)
1972	\$8,561	1
1973	10,500	1.17
1974	10,835	1.22
1975	9,873	1.12
1976	12,230	0.96
1977	14,275	1.27
1978	17,272	1.3
1979	21,649	1.69
1980	26,161	1.4
1981	29,280	1.29
1982	32,158	1.39
1983	37,194	1.38
1984	47,546	1.13
1985 ESTIM.	43,617	1.32*
1986 FORECAST	47,073	1.32*
13 year avg. 1972-84		1.26
5 year avg. 1980-84		1.32

*Marketdata estimate, based on 1980-84 avg.

**SOURCE: U.S. DEPT. OF COMMERCE, CURRENT INDUSTRIAL REPORTS
MARKETDATA CALCULATIONS**

MARKET MIX
PERCENT DISTRIBUTION OF SALES BY TYPE SWITCH
PERCENT OF TOTAL MARKET

	<u>ROTARY SELECTOR.</u>			
	<u>INCL. LEVER &</u>			
	<u>TOGGLE</u>	<u>SLIDE</u>	<u>JOG-LEVER</u>	<u>KEYBOARD</u>
	PERCENT			
1976	2.3	23.3	14.2	NA
1977	5.4	19	16.8	1.7
1978	8.7	18.1	15.1	0.7
1979	13.3	15.9	13.7	1
1980	15.6	17.1	12.3	1.3
1981	20.4	17.2	12.8	2.1
1982	19.9	13.1	16.3	4.9
1983	20.4	13.5	12.6	6.5
1984	20.1	15.2	16.1	9.1
<u>ESTIMATE</u>				
1986	19.6	15.8	15	9.1
<u>FORECAST</u>				
1990	20	15	14	11.5
<u>5-YEAR AVERAGE:</u>				
1976-80	9.1	18.7	14.4	1.2
1980-84	19.3	15.2	14	4.8

	<u>PUSH-BUTTON</u>	<u>SNAP-ACTION</u>	<u>THUMBWHEEL</u>	<u>MISCELL. TYPES</u>
1976	10	NA	1.5	48.6
1977	10.5	2.3	1.6	42.8
1978	12.7	1.6	0.6	42.3
1979	14.1	NA	0.4	41.5
1980	15.4	1.1	0.6	37.8
1981	10.7	-----4.7	-----	32.1
1982	8.6	-----6.9	-----	30.2
1983	9.2	-----2.8	-----	35
1984	9.3	-----2.5	-----	27.3
<u>ESTIMATE</u>				
1986	11	-----2.0	-----	27.5
<u>FORECAST</u>				
1990	12	-----1.8	-----	25.7
<u>5-YEAR AVERAGE:</u>				
1976-80	12.5	1.7	0.9	42.6
1980-84	10.6	-----3.7	-----	32.5

MANUFACTURERS' SHIPMENTS OF SWITCHES, BY TYPE
(\$ Thousands)
(Continued)

	1066LE, INCLUDING MINIATURE & SUBMINIATURE	ANNUAL PERCENT CHANGE	SLIDE, INCLUDING ROCKER, MINIATURE & SUBMINIATURE	ANNUAL PERCENT CHANGE
1976	\$2,760	--	\$27,568	--
1977	9,796	100.0+	34,511	25.2
1978	19,566	99.7	40,664	17.8
1979	48,841	149.6	58,401	43.6
1980	57,350	17.4	62,660	7.3
1981	77,071	34.4	64,703	3.3
1982	88,992	15.5	58,484	-9.6
1983	104,343	17.2	69,094	18.1
1984	107,950	3.5	81,702	18.2
ESTIMATE				
1986	117,800	4.6	94,950	8.1
FORECAST				
1990	146,600	6.1	110,000	7.9

SOURCE: U.S. DEPT. OF COMMERCE, CURRENT INDUSTRIAL REPORTS
MARKET DATA ESTIMATES, FORECASTS, CALCULATIONS

MANUFACTURERS' SHIPMENTS OF ELECTRONIC SWITCHES, BY TYPE
(Continued)
(\$ Thousands)

	ROTARY SELECTOR, INCLUDING LEVER & JOG-LEVER, MINIATURE	ANNUAL % CHANGE	KEYBOARD	ANNUAL % CHANGE
1976	\$16,777	--	*	--
1977	30,578	82.3	\$3,114	--
1978	33,921	10.9	1,583**	-49.2
1979	50,329	48.4	3,625	129
1980	45,067	-10.5	4,657	28.5
1981	48,338	7.3	8,000	71.8
1982	72,539	50.1	21,962	174.5
1983	64,763	-10.1	33,086	50.7
1984	86,333	33.3	48,889	47.8

ESTIMATE

1986 90,150

2.2

54,700

5.9

FORECAST

1990 102,600

3.5

84,300

13.5

* Data for keyboard, snap-action and other switches not elsewhere classified are combined this year to avoid disclosure of individual company sales.

** 15-25% of this figure is estimated.

**SOURCE: U.S. DEPT. OF COMMERCE, CURRENT INDUSTRIAL REPORTS
MARKET DATA ESTIMATES, FORECASTS, CALCULATIONS**

MANUFACTURERS' SHIPMENTS OF ELECTRONIC SWITCHES, BY TYPE
(Continued) (\$Thousands)

	<u>PUSH-BUTTON</u>	<u>ANNUAL %</u>	<u>SNAP-ACTION</u>	<u>ANNUAL %</u>
		<u>CHANGE</u>		<u>CHANGE</u>
1976	\$11,832	—	"	—
1977	19,021	60.8	\$4,118	—
1978	28,500	49.8	3,649	-11.4
1979	51,666	81.3	NA	—
1980	50,035	-3.2	3,880	—
1981	40,228	-19.6	17,702**	100.0+
1982	38,483	-4.3	30,728**	73.6
1983	47,132	22.5	14,124**	-54
1984	49,943	6	13,225**	-6.4
<u>ESTIMATE</u>				
1986	66,100	16.2	12,000**	-4.6
<u>FORECAST</u>				
1990	88,000	8.3	13,200**	2.5
		<u>ANNUAL %</u>	<u>OTHER SWITCHES,</u>	<u>ANNUAL %</u>
	<u>THUMBWHEEL</u>	<u>CHANGE</u>	<u>NOT ELSEWHERE</u>	<u>CHANGE</u>
			<u>CLASSIFIED</u>	
1976	\$1,733	—	\$57,447*	—
1977	2,827	63.1	77,922	35.6
1978	1,437	-49.2	94,751	21.6
1979	1,474	2.6	151,821	60.2
1980	2,121	43.9	123,312	-18.8
1981	NA**	—	121,146	-1.8
1982	NA**	—	134,899	11.4
1983	NA**	—	179,445	33
1984	NA**	—	146,471	-18.4
<u>ESTIMATE</u>				
1986	**	—	165,300	6.4
<u>FORECAST</u>				
1990	**	—	188,300	3.5

* Data for snap-action and "other" switches combined.

**Data for snap-action and thumbwheel switches combined.

The following section consists of computer-searched abstracts relevant to the electronic switch market, obtained by accessing the DIALOG/LOCKHEED database via a local University Business Research Center. The following information sources were represented in the abstracts searched and found for this report, covering the database period from October 1985 to October 1986:

1. Predicasts U.S. Forecast file (for product line sales forecasts).
2. Electronic Business magazine
3. Electronics magazine
4. Electronic Products magazine
5. Frost & Sullivan (market research publisher)
6. Gnostic Concepts (market research publisher)

A summary of forecasts and end-use consumption by type switch and consuming industry is included at the beginning of this section. It encompasses industrial, commercial, military and space, consumer, and OEM end-use sectors.

The information contained in this section is by no means intended to be an all-inclusive literature search. Undoubtedly, there are thousands of additional abstracts stored in various databases which deal with some aspect of the switch market. Marketdata's intent here is to provide the manufacturer, consultant, or industry analyst with a current scan of market developments, forecasts, and outlooks that are different from our own, to give the reader more of a "consensus" view of the market.

The intent is also to introduce the reader to the advantages of utilizing cost and time-effective computerized databases for comprehensive and quick searches, instead of manual searches of individual trade journals and other information sources.

following are several significant findings from the abstracts that follow:

* According to Electronic Business, the biggest OEM end-user segment for switch manufacturers is industrial equipment producers. Also, pushbutton switch sales were estimated to account for over 25% of the OEM market in 1985.

* Electronics predicted that non-lighted pushbutton switch sales would grow fastest of all lines at 24% from 1984-86, while thumbwheel types would *fall* by 8.3%.

* **Electronic Products** forecasts **dual-in-line** switches to outpace all other lines with 7.9% average yearly growth from 1984-89, nearly double the overall switch growth rate of 4.3%.

SUMMARY OF ACTUAL AND FORECASTED SWITCH SALES, BY TYPE
(SOURCE: Electronic Business Magazine)

1985 SALES TO MANUFACTURERS OF:
(\$ Millions)

TYPE SWITCH	INDUSTRIAL		COMMERCIAL		CONSUMER		MILITARY & SPACE EQUIP.		TOTAL OEMS		% OF TOTAL MARKET
	EQUIP.		EQUIP.		EQUIP.						
Dual In Line	25		34		7		8		74		7.7
Lighted Pushbutton	41		22		4		43		110		11.4
Pushbutton (exc. lighted)	47		19		12		55		133		13.8
Rotary	15		4		4		17		40		4.2
Slide	14		7		2		14		38		3.9
Snap-Action	64		21		7		24		116		12.1
Keyboards & Keyswitches	111		136		27		88		362		37.7
Toggle	20		27		7		15		69		7.2
Thumbwheel	14		--		--		5		19		2
TOTAL:	351		270		70		269		961		100
Switches & Keyboards	387		297		72		360		1,062		

FORECASTED SALES GROWTH BY TYPE SWITCH
(SOURCE: Electronics Magazine)

<u>TYPE SWITCH</u>	<u>1986 SALES</u> (\$ Millions)	<u>FORECASTED 1984-86</u> <u>YEARLY GROWTH</u>
Solid-State, incl. Hall-Effect	35	No Change
Coaxial	43	4.9
Snap-Action (small movement)	100	No Change
Lighted Pushbutton	136	7.1
Dual in Line	67	6.3
Toggle	74	7.2
Slide	80	14.3
Pushbutton, exc. lighted	225	24.3
Thumbwheel	33	-8.3
Rotary	117	-1.7
TOTAL SWITCHES:	910	8.2
TOTAL SWITCHES & KEYBOARDS	1,358	9.9

CONSUMPTION BY TYPE SWITCH: PROJECTED FOR 1984-89

(SOURCE: Electronic Products Magazine, Gnostic Concepts)

<u>TYPE SWITCH</u>	<u>GROWTH PER YEAR</u> (Percent)
Dual in Line	7.9
Pushbutton	4.9
Toggle	4.3
Slide	4.2
Rocker	4
Keylock	3.8
Digital	3.5
Rotary	1.5
Snap Action	0.1

TOTAL SWITCHES: 4.3 Avg. Annual Rate

PROJECTED SALES FOR 1984-89, BY TYPE SWITCH

(SOURCE: Frost & Sullivan)

	<u>1984</u>	<u>1989</u>	<u>AVG. YEARLY GROWTH</u>
		(\$ Millions)	(Percent)
Pushbutton	226	351	11.1
Dual in Line	64	99	10.9
Switches & Keyboards	1,250	1,810	9
Keyboards & Keyswitches	445	630	8.3

PRINTS

User:002466 14oct86 P021: PR 3/5/ALL (Items 1-134)
DIALOG (VERSION 2)

PAGE: 89
Item 1 of 134

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1988)

1159639 Electronic 86/07/10 P111 United States
Switches. sales.

YEAR	MIL \$
1985	193.
1986	194.
1987	205.

GROWTH RATE= 3.1%
Gnostic Concepts
CC=1USA PC=3679310 EC=652

1159638 Electronic 86/07/10 P111 United States
Relays. sales.

YEAR	MIL \$
1985	704.
1986	723.
1987	738.

GROWTH RATE= 2.4%
Gnostic Concepts
CC=1USA PC=3679320 EC=652

1128631 Purchasing 86/01/00 P56 United States
Relays. whole price.

YEAR	Index
1985D	100.
1986D	103.1

GROWTH RATE= 3.1%
CC=1USA PC=3679320 EC=744

1127182 Elec Busns 86/01/01 P96 United States
Switches & keyboards. sales to. original equipment mfrs.

YEAR	MIL \$
1984	986.
1985	937.
1986	994.

GROWTH RATE= 6.1%
CC=1USA PC=3679310 EC=664

1127178 Elec Busns 86/01/01 P96 United States
Relays & timers. sales to. original equipment mfrs.

YEAR	MIL \$
1984	432.
1985	391.
1986	382.

GROWTH RATE= -2.3%
CC=1USA PC=3679320 EC=664

1127098 Electronic 86/01/06 P58 United States
Toggle switches. sales.

YEAR	MIL \$
1984	69.
1985	72.
1986	74.

GROWTH RATE= 2.8%
CC=1USA PC=3679314 EC=652

1127097 Electronic 86/01/06 P58 United States
Thumbwheel switches. sales.

YEAR	MIL \$
1984	36.
1985	32.
1986	33.

GROWTH RATE= 3.1%
CC=1USA PC=3679317 EC=652

1127096 Electronic 86/01/06 P58 United States
Solid state switches. sales. (incl Hall effect).

YEAR	MIL \$
1984	35.
1985	35.
1986	35.

GROWTH RATE= 0.0%
CC=1USA PC=3679318 EC=652

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

1127095 Electronic 86/01/06 P58 United States
Snap action switches, sales. (small movement).

YEAR	MIL \$
1984	100.
1985	96.
1986	100.

GROWTH RATE= 4.2%*
CC=1USA PC=3679311 EC=6521127094 Electronic 86/01/06 P58 United States
Slide switches, sales.

YEAR	MIL \$
1984	70.
1985	75.
1986	80.

GROWTH RATE= 6.7%*
CC=1USA PC=3679315 EC=6521127093 Electronic 86/01/06 P58 United States
Rotary switches, sales.

YEAR	MIL \$
1984	119.
1985	168.
1986	117.

GROWTH RATE= -30.4%*
CC=1USA PC=3679316 EC=6521127092 Electronic 86/01/06 P58 United States
Pushbutton switches ex lighted, sales.

YEAR	MIL \$
1984	181.
1985	198.
1986	225.

GROWTH RATE= 13.6%*
CC=1USA PC=3679313 EC=6521127091 Electronic 86/01/06 P58 United States
Lighted pushbutton switches, sales.

YEAR	MIL \$
1984	127.
1985	132.
1986	136.

GROWTH RATE= 3.0%*
CC=1USA PC=3679313 EC=6521127089 Electronic 86/01/06 P58 United States
Dual in line switches, sales.

YEAR	MIL \$
1984	63.
1985	65.
1986	67.

GROWTH RATE= 3.1%*
CC=1USA PC=3679319 EC=6521127088 Electronic 86/01/06 P58 United States
Coaxial switches, sales.

YEAR	MIL \$
1984	41.
1985	42.
1986	43.

GROWTH RATE= 2.4%*
CC=1USA PC=3679319 EC=6521127087 Electronic 86/01/06 P58 United States
Switches & keyboards, sales.

YEAR	MIL \$
1984	1236.
1985	1276.
1986	1358.

GROWTH RATE= 6.4%*
CC=1USA PC=3679310 EC=652

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

1127064 Electronic 86/01/06 P58 United States
Relays, sales.

YEAR	MIL \$
1984	658.
1985	715.
1986	794.

GROWTH RATE= 11.0%*
CC=1USA PC=3679320 EC=6521117687 Frost 1443 85/09/00 P2 United States
Pushbutton switches, sales.

YEAR	MIL \$
1984	226.
1989	351.

GROWTH RATE= 9.2%
CC=1USA PC=3679313 EC=6521117686 Frost 1443 85/09/00 P1 United States
Dual in line switches, sales.

YEAR	MIL \$
1984	64.
1989	99.

GROWTH RATE= 9.1%
CC=1USA PC=3679319 EC=6521117685 #Frost 1443 85/09/00 P1 United States
Switches & keyboards, sales, by type.

YEAR	MIL \$
1984	1250.
1989	1810.

GROWTH RATE= 7.7%
CC=1USA PC=3679310 EC=6521117684 Frost 1443 85/09/00 P1 United States
Keyboards & keyboards, sales.

YEAR	MIL \$
1984	445.
1989	630.

GROWTH RATE= 7.2%
CC=1USA PC=3679312 EC=6521106262 Elec Prod 85/07/15 P49 United States
Dual in line switches, consumption, (value).

YEAR	growth/yr
1984	-
TO	+7.9%
1989	-

GROWTH RATE= 7.9%
Gnostic Concepts
CC=1USA PC=3679319 EC=6561106261 Elec Prod 85/07/15 P49 United States
Pushbutton switches, consumption, (value).

YEAR	growth/yr
1984	-
TO	+4.9%
1989	-

GROWTH RATE= 4.9%
Gnostic Concepts
CC=1USA PC=3679313 EC=6561106260 Elec Prod 85/07/15 P49 United States
Toggle switches, consumption, (value).

YEAR	growth/yr
1984	-
TO	+4.3%
1989	-

GROWTH RATE= 4.3%
Gnostic Concepts
CC=1USA PC=3679314 EC=6561106259 Elec Prod 85/07/15 P49 United States
Slide switches, consumption, (value).

YEAR	growth/yr
1984	-
TO	+4.3%
1989	-

(cont. next page)

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1988)

1984
TO
1989

+4.2%

GROWTH RATE= 4.2%

Gnostic Concepts

CC=1USA PC=3679315 EC=656

1106258 Elec Prod 85/07/15 P49 United States
Rocker switches, consumption, (value).

YEAR growth/yr

1984
TO
1989

+4.4%

GROWTH RATE= 4.0%

Gnostic Concepts

CC=1USA PC=3679319 EC=656

1106257 Elec Prod 85/07/15 P49 United States
Keylock switches, consumption, (value).

YEAR growth/yr

1984
TO
1989

+3.8%

GROWTH RATE= 3.8%

Gnostic Concepts

CC=1USA PC=3679319 EC=656

1106256 Elec Prod 85/07/15 P49 United States
Digital switches, consumption, (value).

YEAR growth/yr

1984
TO
1989

+3.5%

GROWTH RATE= 3.5%

Gnostic Concepts

CC=1USA PC=3679318 EC=656

1106255 Elec Prod 85/07/15 P49 United States
Rotary switches, consumption, (value).

YEAR growth/yr

1984
TO
1989

+1.5%

GROWTH RATE= 1.5%

Gnostic Concepts

CC=1USA PC=3679316 EC=656

1106254 Elec Prod 85/07/15 P49 United States
Snap action switches, consumption, (value).

YEAR growth/yr

1984
TO
1989

+1.1%

GROWTH RATE= 0.1%

Gnostic Concepts

CC=1USA PC=3679311 EC=656

1106253 Elec Prod 85/07/15 P48 United States
Switches, consumption.

YEAR MIL \$

1984 620.
1985 645.
1989 752.

GROWTH RATE= 3.9%

Gnostic Concepts

CC=1USA PC=3679310 EC=656

1106095 Frost 1485 85/07/00 P1 United States
Relays, expend by, computer industry.

YEAR MIL 84\$

1984 93.0
1989 197.

GROWTH RATE= 16.2%

CC=1USA PC=3679320,3573000 EC=664

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

1106094 Frost 1485 85/07/00 P1 United States
Computer industry. expend for. relays.

YEAR	MIL	84\$
1984	93.0	
1989	197.	

GROWTH RATE= 16.2%
CC=1USA PC=3573000,3679320 EC=437

1106093 Frost 1485 85/07/00 P1 United States
Relays. expend by. telecommunications equip industry.

YEAR	MIL	84\$
1984	129.60	
1989	299.	

GROWTH RATE= 18.2%
CC=1USA PC=3679320,3661000 EC=664

1106092 Frost 1485 85/07/00 P1 United States
Telecommunications equip ind. expend for. relays.

YEAR	MIL	84\$
1984	129.60	
1989	299.	

GROWTH RATE= 18.2%
CC=1USA PC=3661000,3679320 EC=437

1106091 Frost 1485 85/07/00 P1 United States
Relays. expend by. military/aerospace sector.

YEAR	MIL	84\$
1984	73.8	
1989	109.	

GROWTH RATE= 8.1%
CC=1USA PC=3679320 EC=664

1106090 Frost 1485 85/07/00 P1 United States
Relays. expend by. industrial users.

YEAR	MIL	84\$
1984	298.40	
1989	545.	

GROWTH RATE= 12.8%

CC=1USA PC=3679320 EC=664
1106089 Frost 1485 85/07/00 P1 United States
Relays. sales.

YEAR	MIL	84\$
1984	619.20	
1989	1187.	

GROWTH RATE= 13.9%
CC=1USA PC=3679320 EC=652

1097659 ElectrnCwk 85/02/25 P56 United States
Switches. productn for. defense electronics equip.

YEAR	MIL	\$
1984	90.3	
1985	93.	
1988	95.3	

GROWTH RATE= 1.4%
Spence, MT mgr. Gnostic Concepts
CC=1USA PC=3679310 EC=623

1097658 ElectrnCwk 85/02/25 P56 United States
Relays. productn for. defense electronics equip.

YEAR	MIL	\$
1984	98.9	
1985	102.	
1988	123.5	

GROWTH RATE= 5.7%
Spence, MT mgr. Gnostic Concepts
CC=1USA PC=3679320 EC=623

1086835 US Outlook 85/01/00 P32-3 United States
Switches & relays. shipments. (constant prices).

YEAR	growth/yr
1985	1.5
T0	1.70
1989	-

GROWTH RATE= 1.7%
CC=1USA PC=3679300 EC=631

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

1080389 #Elec Busns 85/01/01 P192 United States
Switches & keyboards, sales to, original eqp mfrs by
sector.

YEAR	MIL \$
1983	731.
1984	969.
1985	1062.

GROWTH RATE= 9.6%*
CC=1USA PC=3679310 EC=664

1080388 #Elec Busns 85/01/01 P192 United States
Toggle switches, sales to, original eqp mfrs by sector.

YEAR	MIL \$
1983	52.
1984	64.
1985	69.

GROWTH RATE= 7.8%*
CC=1USA PC=3679314 EC=664

1080387 #Elec Busns 85/01/01 P192 United States
Thumbwheel switches, sales to, original eqp mfrs by sector.

YEAR	MIL \$
1983	20.
1984	20.
1985	19.

GROWTH RATE= -5.0%*
CC=1USA PC=3679317 EC=664

1080386 #Elec Busns 85/01/01 P192 United States
Snap action switches, sales to, original eqp mfrs by
sector.

YEAR	MIL \$
1983	94.
1984	108.
1985	116.

GROWTH RATE= 7.4%*
CC=1USA PC=3679311 EC=664

1080385 #Elec Busns 85/01/01 P192 United States
Slide switches, sales to, original eqp mfrs by sector.

YEAR	MIL \$
1983	33.
1984	37.
1985	38.

GROWTH RATE= 2.7%*
CC=1USA PC=3679315 EC=664

1080384 #Elec Busns 85/01/01 P192 United States
Rotary switches, sales to, original eqp mfrs by sector.

YEAR	MIL \$
1983	39.
1984	42.
1985	40.

GROWTH RATE= -4.8%*
CC=1USA PC=3679316 EC=664

1080383 #Elec Busns 85/01/01 P192 United States
Lighted pushbutton switches, sales to, original eqp mfrs by
sector.

YEAR	MIL \$
1983	96.
1984	106.
1985	110.

GROWTH RATE= 3.8%*
CC=1USA PC=3679313 EC=664

1080382 #Elec Busns 85/01/01 P192 United States
Pushbutton switches ex lighted, sales to, original eqp mfrs
by sector.

YEAR	MIL \$
1983	93.
1984	118.
1985	133.

GROWTH RATE= 12.7%*
(cont. next page)

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

CC=1USA PC=3679313 EC=664

1080381 #Elec Busns 85/01/01 P192 United States
Keyboards & keyswitches. sales to. original eqp mfrs by
sector.

YEAR	MIL \$
1983	173.
1984	313.
1985	362.

GROWTH RATE= 15.7%*

CC=1USA PC=3679312 EC=664

1080380 #Elec Busns 85/01/01 P192 United States
Dual in line switches. sales to. original eqp mfrs by
sector.

YEAR	MIL \$
1983	51.
1984	68.
1985	74.

GROWTH RATE= 8.8%*

CC=1USA PC=3679319 EC=664

1080379 #Elec Busns 85/01/01 P192 United States
Circuit breakers. sales to. original eqp mfrs by sector.

YEAR	MIL \$
1983	69.
1984	79.
1985	88.

GROWTH RATE= 11.4%*

CC=1USA PC=3679319 EC=664

1080320 Elec Busns 85/01/01 P192 United States
Switches & keyboards. sales to. military & space equip
mfrs.

YEAR	MIL \$
1983	211.
1984	273.
1985	306.

GROWTH RATE= 12.1%*

CC=1USA PC=3679310 EC=664

1080319 Elec Busns 85/01/01 P192 United States
Toggle switches. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	10.
1984	13.
1985	15.

GROWTH RATE= 15.4%*

CC=1USA PC=3679314 EC=664

1080318 Elec Busns 85/01/01 P192 United States
Thumbwheel switches. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	5.
1984	5.
1985	5.

GROWTH RATE= 0.0%*

CC=1USA PC=3679317 EC=664

1080317 Elec Busns 85/01/01 P192 United States
Snap action switches. sales to. military & space equip
mfrs.

YEAR	MIL \$
1983	20.
1984	22.
1985	24.

GROWTH RATE= 9.1%*

CC=1USA PC=3679311 EC=664

1080316 Elec Busns 85/01/01 P192 United States
Slide switches. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	13.
1984	14.
1985	14.

GROWTH RATE= 0.0%*

(cont. next page)

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

CC=1USA PC=3679315 EC=664
1080315 Elec Busns 85/01/01 P192 United States
Rotary switches. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	16.
1984	17.
1985	17.

GROWTH RATE= 0.0%
CC=1USA PC=3679316 EC=664

1080314 Elec Busns 85/01/01 P192 United States
Lighted pushbutton switches. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	36.
1984	40.
1985	43.

GROWTH RATE= 7.5%
CC=1USA PC=3679313 EC=664

1080313 Elec Busns 85/01/01 P192 United States
Pushbutton switches ex lighted. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	37.
1984	48.
1985	55.

GROWTH RATE= 14.6%
CC=1USA PC=3679313 EC=664

1080312 Elec Busns 85/01/01 P192 United States
Keyboards & keyswitches. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	40.
1984	74.
1985	88.

GROWTH RATE= 18.9%*

CC=1USA PC=3679312 EC=664
1080311 Elec Busns 85/01/01 P192 United States
Dual in line switches. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	5.
1984	7.
1985	8.

GROWTH RATE= 14.3%
CC=1USA PC=3679319 EC=664

1080310 Elec Busns 85/01/01 P192 United States
Circuit breakers. sales to. military & space equip mfrs.

YEAR	MIL \$
1983	25.
1984	28.
1985	32.

GROWTH RATE= 14.3%
CC=1USA PC=3679319 EC=664

1080309 Elec Busns 85/01/01 P192 United States
Switches & keyboards. sales to. industrial equipment mfrs.

YEAR	MIL \$
1983	270.
1984	355.
1985	387.

GROWTH RATE= 9.0%
CC=1USA PC=3679310 EC=664

1080308 Elec Busns 85/01/01 P192 United States
Toggle switches. sales to. industrial equipment mfrs.

YEAR	MIL \$
1983	14.
1984	18.
1985	20.

GROWTH RATE= 11.1%* (cont. next page)

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

CC=1USA PC=3679314 EC=664

1080307 Elec Busns 85/01/01 P192 United States
Thumbwheel switches, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	14.
1984	15.
1985	14.

GROWTH RATE= -6.7%*

CC=1USA PC=3679317 EC=664

1080306 Elec Busns 85/01/01 P192 United States
Snap action switches, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	50.
1984	59.
1985	64.

GROWTH RATE= 8.5%*

CC=1USA PC=3679311 EC=664

1080305 Elec Busns 85/01/01 P192 United States
Slide switches, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	11.
1984	13.
1985	14.

GROWTH RATE= 7.7%*

CC=1USA PC=3679315 EC=664

1080304 Elec Busns 85/01/01 P192 United States
Rotary switches, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	15.
1984	16.
1985	15.

GROWTH RATE= -6.2%*

CC=1USA PC=3679316 EC=664

1080303 Elec Busns 85/01/01 P192 United States
Lighted pushbutton switches, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	37.
1984	40.
1985	41.

GROWTH RATE= 2.5%*

CC=1USA PC=3679313 EC=664

1080302 Elec Busns 85/01/01 P192 United States
Pushbutton switches ex lighted, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	32.
1984	42.
1985	47.

GROWTH RATE= 11.9%*

CC=1USA PC=3679313 EC=664

1080301 Elec Busns 85/01/01 P192 United States
Keyboards & keyswitches, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	53.
1984	96.
1985	111.

GROWTH RATE= 15.6%*

CC=1USA PC=3679312 EC=664

1080300 Elec Busns 85/01/01 P192 United States
Dual in line switches, sales to, industrial equipment mfrs.

YEAR	MIL \$
1983	16.
1984	23.
1985	25.

(cont. next page)

PRINTS

User: 002466 14oct86 P021: PR 3/5/ALL (items 1-134)
DIALOG (VERSION 2)

PAGE: 99
Item 81 of 134

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

GROWTH RATE= 8.7%*

CC=1USA PC=3679319 EC=664

1080299 Elec Busns 85/01/01 P192 United States
Circuit breakers. sales to. industrial equipment mfrs.

YEAR	MIL \$
1983	24.
1984	28.
1985	31.

GROWTH RATE= 10.7%*

CC=1USA PC=3679319 EC=664

1080298 Elec Busns 85/01/01 P192 United States
Switches & keyboards. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	52.
1984	64.
1985	72.

GROWTH RATE= 12.5%*

CC=1USA PC=3679310 EC=664

1080297 Elec Busns 85/01/01 P192 United States
Toggle switches. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	6.
1984	7.
1985	7.

GROWTH RATE= 0.0%*

CC=1USA PC=3679314 EC=664

1080296 Elec Busns 85/01/01 P192 United States
Snap action switches. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	6.
1984	7.
1985	7.

CC=1USA PC=3679311 EC=664

1080295 Elec Busns 85/01/01 P192 United States
Slide switches. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	2.
1984	2.
1985	2.

GROWTH RATE= 0.0%*

CC=1USA PC=3679315 EC=664

1080294 Elec Busns 85/01/01 P192 United States
Rotary switches. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	4.
1984	4.
1985	4.

GROWTH RATE= 0.0%*

CC=1USA PC=3679316 EC=664

1080293 Elec Busns 85/01/01 P192 United States
Lighted pushbutton switches. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	3.
1984	4.
1985	4.

GROWTH RATE= 0.0%*

CC=1USA PC=3679313 EC=664

1080292 Elec Busns 85/01/01 P192 United States
Pushbutton switches ex lighted. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	10.
1984	11.
1985	12.

GROWTH RATE= 0.0%*

(cont. next page)

DIALOG File 81: PTS US Forecasts - 71-86/Sep (Copr. Predicasts Inc. 1986)

GROWTH RATE= 9.1%*

CC=1USA PC=3679313 EC=664

1080291 Elec Busns 85/01/01 P192 United States
Keyboards & keyswitches. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	15.
1984	22.
1985	27.

GROWTH RATE= 22.7%*

CC=1USA PC=3679312 EC=664

1080290 Elec Busns 85/01/01 P192 United States
Dual in line switches. sales to. consumer equipment mfrs.

YEAR	MIL \$
1983	4.
1984	6.
1985	7.

GROWTH RATE= 16.7%*

CC=1USA PC=3679319 EC=664

1080289 Elec Busns 85/01/01 P192 United States
Switches & keyboards. sales to. commercial equipment mfrs.

YEAR	MIL \$
1983	198.
1984	277.
1985	297.

GROWTH RATE= 7.2%*

CC=1USA PC=3679310 EC=664

1080288 Elec Busns 85/01/01 P192 United States
Toggle switches. sales to. commercial equipment mfrs.

YEAR	MIL \$
1983	22.
1984	26.
1985	27.

GROWTH RATE= 3.8%*

CC=1USA PC=3679314 EC=664

1080287 Elec Busns 85/01/01 P192 United States
Snap action switches. sales to. commercial equipment mfrs.

YEAR	MIL \$
1983	18.
1984	20.
1985	21.

GROWTH RATE= 5.0%*

CC=1USA PC=3679311 EC=664

1080286 Elec Busns 85/01/01 P192 United States
Slide switches. sales to. commercial equipment mfrs.

YEAR	MIL \$
1983	7.
1984	8.
1985	7.

GROWTH RATE= -12.5%*

CC=1USA PC=3679315 EC=664

1080285 Elec Busns 85/01/01 P192 United States
Rotary switches. sales to. commercial equipment mfrs.

YEAR	MIL \$
1983	4.
1984	5.
1985	4.

GROWTH RATE= -20.0%*

CC=1USA PC=3679316 EC=664

1080284 Elec Busns 85/01/01 P192 United States
Lighted pushbutton switches. sales to. commercial equipment mfrs.

YEAR	MIL \$
1983	20.
1984	22.
1985	22.

GROWTH RATE= 0.0%*

(cont. next page)

DIALOG File 81: PTS US Forecasts - 71-88/Sep (Copr. Predicasts Inc. 1988)

CC=1USA PC=3679313 EC=664
1080283 Elec Busns 85/01/01 P192 United States
Pushbutton switches ex lighted, sales to, commercial
equipment mfrs.

YEAR	MIL \$
1983	14.
1984	17.
1985	19.

GROWTH RATE= 11.8%
CC=1USA PC=3679313 EC=664

1080282 Elec Busns 85/01/01 P192 United States
Keyboards & keyswitches, sales to, commercial equipment
mfrs.

YEAR	MIL \$
1983	65.
1984	121.
1985	136.

GROWTH RATE= 12.4%
CC=1USA PC=3679312 EC=664

1080281 Elec Busns 85/01/01 P192 United States
Dual in line switches, sales to, commercial equipment mfrs.

YEAR	MIL \$
1983	26.
1984	32.
1985	34.

GROWTH RATE= 6.2%
CC=1USA PC=3679319 EC=664

1080280 Elec Busns 85/01/01 P192 United States
Circuit breakers, sales to, commercial equipment mfrs.

YEAR	MIL \$
1983	20.
1984	23.
1985	25.

GROWTH RATE= 8.7%
CC=1USA PC=3679319 EC=664

1080015 Elec Busns 85/01/01 P190 United States
Relays & timers, sales to, original eqp mfrs by sector.

YEAR	MIL \$
1983	392.
1984	420.
1985	407.

GROWTH RATE= -3.1%
CC=1USA PC=3679320 EC=664

1080013 Elec Busns 85/01/01 P190 United States
Time delay relays, sales to, original eqp mfrs by sector.

YEAR	MIL \$
1983	23.
1984	24.
1985	22.

GROWTH RATE= -8.3%
CC=1USA PC=3679327 EC=664

1080012 Elec Busns 85/01/01 P190 United States
Telephone type relays, sales to, original eqp mfrs by
sector.

YEAR	MIL \$
1983	24.
1984	25.
1985	22.

GROWTH RATE= -12.0%
CC=1USA PC=3679322 EC=664

1080011 Elec Busns 85/01/01 P190 United States
Solid state relays, sales to, original eqp mfrs by sector.

YEAR	MIL \$
1983	42.
1984	47.
1985	45.

GROWTH RATE= -4.3%
CC=1USA PC=3679328 EC=664

Estimating market share by company is always a difficult task, since one is dealing with imperfect information from a variety of sources. For some firms, exact "switches only" sales are known. Some companies are publicly owned and publish annual reports, 10K financial statements, or are covered by investment/financial services such as Standard & Poors, Moodys, and Value Line. Some are privately held corporations, and publish no public information. Others are one of many divisions of a larger parent company, whose switches sales are buried amongst the total.

Bearing this in mind, Marketdata has used all of the above-mentioned information sources, plus a few others, to derive the following share of market estimates. In the past, we have found that share of industry Production Worker Employment can be a rough proxy to measure market share. The Marketing Economics Institute classified production worker employment in 1982, by Industry SIC code. Marketdata used these employment figures for SIC 3679 (miscellaneous electronic components manufacturing-which includes switches) as part of the estimating methodology. We also considered how frequently companies were mentioned in trade journal articles/analyses of the switch market, and their advertising activity or exposure.

Of the 310+ companies active in the U.S. switch market, we estimate that the Top 20 companies capture 69.5% of the sales. The Top 5 are estimated to capture 33.3%, the Top 10-52.2%, the Top 15-62.7%. This assumes the following.....

1) Switch shipments by U.S. producers as reported by the Commerce Dept. and estimated by Marketdata for 1986 totalled \$601 million. This figure was inflated by 25% to allow for distributor mark-up, to represent the true value of the market to the end-user--or \$751 million.

2) U.S. imports represent about 16% of this total, or \$120 million. These are sales made by Japanese and European firms.

SHARE OF MARKET ESTIMATES (Continued)

Following are Marketdata's estimates of market share by company:

<u>Rank/Company</u>	<u>Estim. Sales</u>	<u>Estim. Market Share</u>
1. Microswitch	\$79 Mill.	10.5%
2. Augat	53	7.1
3. Molex	43	5.7
4. CTS Corp.	40	5.3
5. Oak Industries	<u>35</u>	<u>4.7</u>
Top 5 Total:	250	33.3
6. Centralab (North Amer. Phillips)	32	4.3
7. Grayhill	32	4.3
8. Hubbell, Inc.	28	3.7
9. Cherry Corp.	25	3.3
10. AMP	<u>25</u>	<u>3.3</u>
Top 10 Total:	392	52.2
11. Potter & Brumfield (AMF)	18	2.4
12. ITT Schadow	16	2.1
13. Standard Grigsby	15	2.0
14. Carlingswitch	15	2.0
15. EECO	<u>15</u>	<u>2.0</u>
Top 15 Total:	471	62.7
16. ITW	14	1.9
17. Stackpole	10	1.3
18. Cortron (Illinois Tool Works)	10	1.3
19. Switchcraft	8.5	1.1
20. T-Bar	<u>8.5</u>	<u>1.1</u>
Top 20 Total:	522	69.5%
Allen Bradley, Arrow-Hart, Crouse Hinds, Cutler-Hammer, All Other U.S. Companies:	109	14.5%
All Foreign Companies (imports)	120	15.9%

SHARE OF MARKET ESTIMATES (Continued)

At least a dozen foreign competitors are present, mostly Japanese. The German giant, Siemens, also sells switches in the U.S. Amongst the Japanese firms are: Alps Electric, Omron, Copal U.S.A., Hi-Tek (mostly concentrated in keyboards), DAI Ichi Shoji of America, Futaba Corp. of America, Hirose Electric, Oshino Electric, Panasonic, Satori Electric, Shogyo International, and Shokai Far East Ltd.

Furthermore, according to Electronic News' annual Keyboards & Switches Spotlight analysis, following are estimated shares of specific product line areas by company.....

Microswitch captures 27% of the **keyboard** switch market.

Cherry Corp. captures 11% of the **thumbwheel** and 13% of the **keyboard** switch market.

CTS Corp. captures 30% of the \$50 million **DIP switch** market, as does Grayhill and AMP. CTS also takes 11% of the **rotary** switch market.

Standard Grigsby captures 13% of the **rotary** switch market.

Oak Industries captures 23% of the **rotary** switch market.

EECO captures 33% of the **thumbwheel** switch market.

Grayhill captures 11% of the **rotary** switch market.

MAJOR END-USER SECTORS: PERFORMANCE AND DEMAND

THE MILITARY MARKET

Various estimates exist about the relative size and importance of the military & space market for switches consumption. Electronic Business magazine estimated that it accounted for \$269 million in OEM sales during 1985, or 28% of the total OEM market. They further estimated that 38% of total OEM sales to military & space equipment makers were related to "keyboards and keyswitches", the largest segment, followed by pushbutton types at 25% and snap-action types at 12%.

According to Assistant Secretary of Defense James P. Wade Jr., changes are on the horizon at the DOD. He stated that a variety of actions have been taken to overcome procurement system impediments, such as an emphasis on "producibility", factory modernization, increased competition, scrutiny of overhead costs, increased contract auditing and surveillance activities. There will be a renewed philosophy of continuous quality improvement.

Mr. Wade stated that: "Competition is too frequently based just on price, and an 'award to the lowest bidder' mentality is too pervasive. We plan to move away from defining equipment requirements in minimally acceptable terms to a system whereby the best quality equipment at an acceptable price is our recognized objective".

U.S. production of military electronics is expected to be up only slightly in 1986, but at \$50 billion it is a huge market. The Pentagon's better-funded projects include the Strategic Defense Initiative (Star Wars), the Very High Speed Integrated Circuits program, Defense Advanced Research Program Agency (DARPA) efforts, and office technology projects spread amongst various military agencies. The DOD is also becoming a big buyer of microcomputers for its administrative operations.

Although projections for defense electronics spending are flat for 1986 and 1987 there is a continuing emphasis on highly sophisticated systems and weapons program upgrades. U.S. production of military electronics equipment should grow by 8% to \$49.6 billion, down from 1985's growth of 15%. 1987 growth should fall in the 4-5% range, to about \$52 billion.

MAJOR END-USERS (CONTINUED)

Later in this section is a breakdown of Army, Navy and Air Force research, development, test and engineering (RDT & E) program funding from fiscal year 1986-88. Only those programs valued at \$50 million or more for FY 1988 are included. Army RDT & E spending is expected to grow 30.2% over the two years, to \$6.3 billion. Air Force programs account for the largest chunk of business at \$17.85 billion, up 29.5% over the period. Navy programs will be up only 5.2% to \$10.6 billion by 1988.

The Trident-2 missile program's funding is expected to drop from \$2.1 billion in 1986 to \$1.18 billion by 1988. Within the Air Force, the Small ICDM program RDT & E will nearly double from \$1.44 billion to \$2.73 billion. The C-17 Transport program will more than double, from \$373 million to \$902 million, and the Advanced Tactical Fighter program will double from \$165 million to \$344 million.

In general, the way the military does business with the electronics industry will be changing noticeably. It will look more seriously at increasing competition, prototyping weapons before they are purchased, and buying more hardware and software "off the shelf". The DOD has also begun to work more closely with systems integrators who will operate as prime contractors-working with multiple vendors to merge hardware, software and communications.

THE COMMERCIAL EQUIPMENT MARKET

1. COMPUTERS/DATA PROCESSING

Total demand is expected to rise 14% in 1986, according to Electronics magazine, better than 1985's rate of 11%. During 1985, the industry recorded gains in all product areas *except* personal computers. For 1986 the best growth is expected in peripheral equipment, 18% to \$7.82 billion, while office automation sales rise 9.7% to \$9.78 billion. Total computer system sales are slated to rise 13.8% to \$65.28 billion. Demand for terminals should increase, helped by a proliferation of multi-user microcomputers and small business systems.

Sectors of the economy that haven't fully recovered from the 1981-82 recession are populated by companies that are still reluctant to invest large sums to computerize their offices. Uncertainty over an economy now well past its third year of recovery has led firms to reexamine

and reduce capital spending plans. Also, customers purchased a huge amount of hardware in 1984 (especially personal and microcomputers), and are still "digesting" what they bought--not being totally sure that the system improved their productivity and efficiency. This uncertainty was caused in large part by a lack of adequate applications software and communications products. Detailed breakdowns of market size and growth, by type system, appear in tables later on in this section. Above-average 1986 growth is expected for: microcomputers, engineering work stations, and supercomputers.

The manufacturing community could develop into a strong market, due to the emerging **Manufacturing Automation Protocol** being promoted by General Motors and other large firms. This "MAP" is seen as a way to enable industrial machinery to communicate via computers to enhance operational efficiency. Computer makers often design new systems to be as internally similar to their predecessors as possible. Consequently, new designs often call for the use of inexpensive components which can be stocked in a central location, readily available either from distributors or on the open market, as demand peaks and falls.

2. COMMUNICATIONS EQUIPMENT

Electronics forecasts consumption to rise 14% during 1986, the same as in 1985. Total sales should then reach \$23.6 billion.

Telecommunications equipment is the largest segment at \$6.6 billion (up 9.4% in 1986), followed by data communications products at \$4.3 billion (up 17.7%).

During 1985, buyers were faced with confusing new combinations of competitors in the market, as well as an abundance of new products. Their wait-and-see attitude contributed to a cut-back in consumption. The market for PBHs will heat up, as suppliers and regional Bell operating companies scramble for the market. The market is volatile because of the teaming up of major players such as IBM and Rolm and Wang Labs with Intecom. Pressure is also being exerted by the operating companies as they expand their Centrex stations into more business locations. The North American Telecommunication Association in Washington predicts that the market for Bell Centrex stations will expand 9% this year, a potential loss of \$800 million in business for PBH vendors, or about 25% of the expected market in 1986.

Fiber Optics is the biggest issue now in communications. Because of the ability of fiber optic links to handle such heavy loads, these lines are in demand by the cable TV industry, installers of computer-linked businesses and factories, and the military. But, the telecommunications market retains the lion's share: more than 40% of the \$1.5 billion fiber optic market in 1986. This share is expected to grow to 50% by 1990. Also, price has been reduced at the same time that performance has been upgraded. The telephone industry will also benefit from fiber optics, since this technology can handle substantially higher traffic and transmit signals over longer distances between repeater stations. Repeaters are one of the most unreliable elements of telephone networks, especially when handling computer data.

3. INSTRUMENTATION

Electronics reported that test & measurement instrument sales edged up only 1% during 1985, but are expected to rebound to a strong 12% gain in 1986. This market is forecast to reach \$6.78 billion this year. About 70% of the market consists of general test equipment, with the remainder in automated test equipment (ATE). ATE includes: discrete component test systems, IC testers, and various types of PC-board testers related to the semiconductor market. General test equipment includes a wide variety of 25+ instruments such as: oscillators, panel meters, counters, generators, oscilloscopes, recorders, spectrum analyzers, etc.

During 1985, a strong U.S. dollar gave imports the edge in the American market. Reduced factory production of electronic equipment wiped out orders for additional testing tools (especially ATE), and reduced R & D programs by both industry and government caused orders to be dropped for sophisticated and expensive test equipment.

For 1986, a continued fall in the dollar's value should make foreign goods more expensive here, giving U.S. suppliers a boost. General test equipment sales are expected to rise 15% to \$4.8 billion. Part of the 1985 problem, in addition to a general sluggishness in the overall electronics industry, was the shift by the DOD to funding new weapons programs rather than putting more money into the maintenance of existing systems. ATE makers are moderately optimistic about 1986, and **Electronics'** market forecast foresees demand growing 5% this year.

In microprocessor development systems, the four major suppliers--HP, Intel, Tektronix and Motorola--have replaced their proprietary systems architectures with open architectures, thereby responding to the problems that emerged in 1985.

THE INDUSTRIAL ELECTRONICS MARKET

Electronics sees this market's demand rising 14% to \$8.7 billion in 1986, higher than the 12% gain of 1985, but for performance to be "uneven". Uncertainty about the direction of the U.S. economy points to caution in the overall market (especially process control equipment). But, the future for robotic systems looks bright.

Process control equipment sales are estimated to total \$4.67 billion in 1986, nearly 54% of the total industrial electronic equipment market, while robots account for \$510 million and pollution control equipment for \$1.18 billion. The sluggish U.S. manufacturing sector, much of which has not fully recovered from the 1981-82 recession, coupled with a leveling of demand from petrochemical firms, means a probable slowdown for process control equipment sales. Equipment here includes: data acquisition systems, process instrumentation, sequence controllers and data loggers.

On the other hand, robotics is the new high-growth segment. Besides increased factory automation to boost labor productivity and international competitiveness, optimism also stems from the commitment of many manufacturers (including GM) and equipment suppliers to the proposed **Manufacturing Automation Protocol** system. This system allows diverse pieces of industrial equipment to communicate with each other.

Some segments of the industrial robots market (spot welding in car manufacturing) are becoming saturated, but new demands are beginning to emerge. Among these are the use of robots in electronic components assembly and systems, and in "clean rooms" at semiconductor plants.

THE CONSUMER ELECTRONICS MARKET

The consumer electronics end-use sector for switches is a small one--perhaps 7 % of the total market. Consumer **video** equipment (color and black & white TVs, projection TVs, VCRs, video cameras, videodisk players) constitutes a \$13.7 billion market, forecast to

rise 14% in 1986, on top of an 18% gain during 1985. Consumer audio equipment (car audio, stereo systems, radios, tape recorders, CD players, etc.) will account for \$6.78 billion in sales, up 6.6% in 1986. This follows a 4.9% gain in 1985. Other consumer electronic products include: calculators, clocks, games, musical instruments, microwave ovens, electronic watches, and telephone answering machines. These products will account for \$4.38 billion in sales in 1986, up 5.6%. This follows a 6% gain in 1985.

Electronics expects U.S. consumers to continue to spend freely on sophisticated electronic products this year, meaning that manufacturers of such high-ticket items as VCRs, compact-disk players, and stereo and projection TVs can expect another year of healthy growth. Consumption of electronic products for the home should be up 11% in 1986 to almost \$25 billion.

Later on in this section are numerous tables detailing 1982-1986 factory sales, in units and dollars, of such consumer electronics equipment as: home computers, telephones, answering machines, color TVs, black & white TVs, projection TVs, VCRs, CD players, portable tape recorders, radios, and car audio equipment, provided by the **Electronic Industries Association**.

RECENT AND FORECASTED PERFORMANCE OF
MAJOR SWITCHES END-USER SECTORS
 (1984-1986)

				Percent Change From Prior Year	
	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1985</u>	<u>1986</u>
	(\$ Millions)				
<u>Commercial Equipment</u>					
<u>Total Data Processing Equipment</u>	\$51,741	\$57,373	\$65,289	10.9	13.8
All Computer Systems	25,568	28,090	31,956	9.9	13.8
All I/O Peripherals	5,930	6,630	7,821	11.8	18.0
All Office Automation	7,785	8,920	9,783	14.6	9.7
<u>Total Communications Equipment</u>	18,282	20,792	23,607	13.7	13.5
All Telecommunications	5,510	6,043	6,613	9.7	9.4
TV Equipment	1,252	1,363	1,516	8.9	11.2
Fiber Optic Systems	879	1,202	1,539	36.7	28.0
<u>Test Instruments</u>	5,998	6,039	6,781	0.9	12.3
<u>Industrial Electronic Equipment</u>	6,784	7,626	8,682	12.4	13.8
Consumer Electronics	20,085	22,507	24,897	12.1	10.6

SOURCE: Electronics Magazine Annual Market
 Forecast, Percent Change Calculations
 by Marketdata

PERFORMANCE OF THE DATA PROCESSING
MARKET, BY TYPE EQUIPMENT
(1984-1986)

	(\$ Millions)			<u>Percent Change From Prior Year</u>	
	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1985</u>	<u>1986</u>
<u>Computer Systems</u>					
Personal Computers (under \$5,000)	\$1,180	\$1,090	\$1,260	- 7.6	15.6
Micro computers (\$5-20,000)	2,374	2,778	3,361	17.0	21.0
Minicomputers (\$20-100,000)	5,870	6,395	7,099	8.9	11.0
Superminis (\$100-400,000)	6,545	7,060	7,836	7.9	11.0
Mainframes (\$400,000-\$5 million)	8,290	8,870	9,897	7.0	11.6
Supercomputers	520	840	1,020	61.5	21.4
Engineering work stations	789	1,057	1,483	34.0	40.3
<u>Office Automation</u>					
Copying equipment	4,090	4,525	4,920	10.6	8.7
Electronic Typewriters	865	1,210	1,285	39.9	6.2
Word processors	2,830	3,185	3,578	12.5	12.3
<u>Peripherals</u>					
High-speed line printers	420	468	515	11.4	10.0
Medium-speed line printers	1,140	1,270	1,495	11.4	17.7
Slow serial printers	2,570	2,840	3,440	10.5	21.1

SOURCE: Electronics Magazine, Percent Change
Calculations by Marketdata

PERFORMANCE OF THE COMMUNICATIONS
EQUIPMENT MARKET, BY DETAILED
PRODUCT LINE
(1984-1986)

	(\$ Millions)			<u>Percent Change From Prior Year</u>	
	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1985</u>	<u>1986</u>
<u>Complete Fiber Optic Systems</u>	\$ 521	\$ 714	\$ 943	37.0	32.1
<u>Telecommunications Equipment</u>					
<u>Data Switching Systems</u>					
Central Office	73	86	95	17.8	10.5
PABX	140	162	178	15.7	9.9
<u>Voice Switching Systems</u>					
Central Office	2,310	2,570	2,820	11.3	9.7
PABX	2,800	2,920	3,110	4.3	6.5
<u>Packet-Switching Systems</u>	187	305	410	63.1	34.4
<u>Total Data Communications</u> (moderns, multi-plexers, controllers)					
<u>TV Equipment, Total</u>	1,252	1,363	1,516	8.9	11.2
<u>Radio, Total</u>	2,745	3,209	3,742	16.9	16.6

SOURCE: Electronics Magazine, Percent Change Calculations by Marketdata

RECENT AND FORECASTED PERFORMANCE OF
THE INDUSTRIAL ELECTRONIC EQUIPMENT
SECTOR, BY TYPE EQUIPMENT

(1984-1986)

(\$ Millions)

Percent Change From Prior Year

	<u>1984</u>	<u>1985</u>	<u>1986</u>	<u>1985</u>	<u>1986</u>
<u>Total Equipment</u>	\$6,784	\$7,626	\$8,682	12.4	13.8
Energy Manage- ment Equipment	481	519	558	7.9	7.5
Inspection Systems	347	397	456	14.4	14.9
Motor Controls	771	752	823	-2.5	9.4
Numerical Con- trol Equipment	278	345	378	24.1	9.6
Pollution Con- trol Equipment	936	1,021	1,183	9.1	15.9
Process Control Equipment	3,560	4,111	4,671	15.5	13.6
Robot Systems	333	395	510	18.6	29.1
Thickness Gauges and Control	78	86	93	10.3	8.1

SOURCE: Electronics Magazine, Market Forecast,
Percent Change Calculations by Marketdata

**THE CONSUMER ELECTRONICS MARKET
TRENDS IN SALES TO DEALERS, BY TYPE EQUIP.**

	TOTAL SALES TO DEALERS IN UNITS (Thousands)	TOTAL FACTORY SALES (\$ Millions)
<u>HOME COMPUTERS*</u>		
1982	2, 000	1, 300
1983	4, 800	1, 950
1984	5, 100	2, 250
1985	4, 100	2, 050
1986	4, 500	2, 475

*Computer systems retailing for under \$2, 000, intended for home

<u>TELEPHONES</u>		
1982	5, 700	400
1983	19, 700	925
1984	30, 300	1, 250
1985	26, 000	970
1986	26, 500	966

<u>TELEPH. ANSWERING MACHINES</u>		
1982	850	110
1983	2, 200	190
1984	3, 000	230
1985	3, 600	266
1986	4, 400	322

<u>COLOR TV RECEIVERS*</u>		
1980	10, 897	4, 210
1981	11, 157	4, 349
1982	11, 366	4, 253
1983	13, 986	5, 002
1984	16, 083	5, 538
1985 (Projected)	16, 900	5, 580
1986 (Estimated)	16, 700	5, 500

*Includes monitors for consumer use.

SOURCE: ELECTRONIC INDUSTRIES ASSOCIATION

THE CONSUMER ELECTRONICS MARKET
TRENDS IN SALES TO DEALERS, BY TYPE EQUIP.
 (Continued)

TOTAL SALES	
TO DEALERS	TOTAL FACTORY
<u>IN UNITS</u>	<u>SALES</u>
(Thousands)	(\$ Millions)

BLACK & WHITE TVS*

1980	6, 285	588
1981	5, 541	505
1982	5, 765	507
1983	5, 697	465
1984	4, 909	419
1985 (Projected)	3, 800	305
1986 (Estimated)	3, 300	205

*Includes monitors (green,amber) for consumer use.

PROJECTION TV*

1980	57	NA
1981	122	287
1982	117	236
1983	144	268
1984	195	385
1985 (Projected)	260	460
1986 (Estimated)	320	544

*Incl. all indirect-view color TV.

SATELLITE EARTH

STATION SYSTEMS

1985	600	900
1986	700	1, 100

HOME RADIOS

(Table,Clock,Portable)

1980	28, 062	468
1981	29, 415	501
1982	32, 663	530
1983	40, 362	565
1984	44, 142	661
1985 (Projected)	40, 000	560
1986 (Estimated)	40, 000	560

THE CONSUMER ELECTRONICS MARKET
TRENDS IN SALES TO DEALERS, BY TYPE EQUIPMENT
 (Continued)

	TOTAL SALES TO DEALERS IN UNITS	TOTAL FACTORY SALES
	(Thousands)	(\$ Millions)
<u>VIDEOCASSETTE RECORDERS</u>		
1980	805	621
1981	1,361	1,127
1982	2,035	1,303
1983	4,091	2,162
1984	7,616	3,585
1985 (projected)	11,850	4,870
1986 (estimated)	12,500	4,900
<u>TOTAL AUDIO COMPONENT & COMPACT SYSTEMS</u>		
1980	3,744	809
1981	2,882	720
1982	2,640	573
1983	3,058	630
1984	3,167	976
1985 (projected)	3,200	920
1986 (estimated)	3,200	905
<u>COMPACT DISC PLAYERS</u>		
(Incl. portable type)		
1983	35	15
1984	208	68
1985 (projected)	850	187
1986 (estimated)	1,500	315
<u>PORTABLE TAPE RECORDERS & PLAYERS</u>		
1984	10,199	299
1985 (projected)	10,000	270
1986 (estimated)	10,000	260

SOURCE: ELECTRONIC INDUSTRIES ASSOCIATION

THE CONSUMER ELECTRONICS MARKET
TRENDS IN SALES TO DEALERS, BY TYPE EQUIP.
 (Continued)

	TOTAL FACTORY SALES
	(\$ MILLIONS)
<u>CAR AUDIO EQUIP.</u>	
1980	1,368
1981	2,000
1982	2,100
1983	1,900
1984	2,484
1985 (Projected)	2,800
1986 (Estimated)	3,000

*Inc. domestic factory-installed and aftermarket equip.

SOURCE: ELECTRONIC INDUSTRIES ASSOCIATION

**FUNDING PROJECTIONS FOR MAJOR DEFENSE DEPARTMENT
RESEARCH, DEVELOPMENT, TEST & ENGINEERING PROGRAMS:**

FISCAL YEAR 1986-88

(\$ Millions)

(Ranked By Program Size, Only Those Programs Valued At \$50 Million or
More For FY 1988)

<u>ARMY</u>	<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>% Growth 1986-88</u>
Total RDT & E	\$4, 841	\$5, 550	\$6, 305	30.2%
LHX Helicopter	---	---	194	---
Air Defense Alternatives	31	104	189	100.0+
Krajelein Missile Range	152	163	176	15.8
Advanced Antitank Weapon Syst.	60	49	142	136.7
Satcom Ground Terminals	51	94	105	105.9
Joint Tactical Missile Syst.	128	88	98	-23.5
Advanced Field Artillery				
Tactical Data System	20	40	67	100.0+
Surface-To-Surface Missile Syst.	31	43	52	67.7
Terminally Guided Projectiles				
Advanced Tech.	14	28	51	100.0+
Patriot Missile Improvement	---	40	50	---
 <u>NAVY</u>				
Total RDT & E	10, 077	10, 587	10, 604	5.2
Trident-2 Missile	2, 104	1, 633	1, 180	-44.0
V-22 Aircraft	---	387	483	---
Defense Research Sciences	333	350	364	9.3
Submarine Combat Syst.	200	317	277	38.5
SSN-21 Submarine Devel.	---	257	225	---
Link Spruce Program	35	94	170	100+
F-14 Upgrade	348	268	157	-54.9
Advanced Air-To-Surf.Missile	47	122	149	100+
Sea Lance	---	118	131	---
Aegis Improvements	122	135	117	-4.0
Navy Strategic Communications	121	143	97	-19.8
Navstar GPS	62	77	89	43.5

MAJOR DEFENSE DEPARTMENT PROGRAMS (CONTINUED)

- 59 -

	FY 1986	FY 1987	FY 1988	% Growth 1986-88
ASW Tech.	85	91	88	3.5
Chalk Eagle Project	69	79	87	26.1
AAW/ASKW Tech.	77	75	82	6.5
P-3 Modernization	33	97	82	148.5
Aircraft Support Equip.	20	32	80	100+
Mark 50 Light Weight Torpedo	158	149	80	-49.4
Standard Missile Improvement	45	46	76	68.8
Link Laurel Program	35	47	75	114.3
A-6F Aircraft	236	143	74	-68.6
Tomahawk Cruise Missile	62	68	71	14.5
EMSP Enhanced Signal Processor	93	100	67	-28.0
Pilot Fish Program	94	75	62	-35.0
Acoustic Search Sensors Eng.	30	57	59	96.7
Elec. Warfare Counter Response	79	70	59	-25.7
Electronic Warfare Simulation	35	52	58	65.7
Marine Corps C3 Syst.	39	40	58	48.7
IFF Systems Development	17	23	55	100+
Shipboard Elec. Warfare Improve.	62	52	55	-11.3
ASW Surveillance	17	26	53	100+
Defense Meteorological Satellite	46	49	53	15.2

AIR FORCE

Total RDT & E	13, 787	17, 275	17, 857	29.5
Small ICBM	1, 442	2, 117	2, 734	89.6
C-17 Transport	373	612	902	141.8
Advanced Tactical Fighter	165	294	344	108.5
JSTARS	---	356	336	---
Test & Evaluation Support	426	304	312	-26.8
Milstar AF Terminals	124	299	291	134.7
Space Shuttle Operations	75	176	227	100+
Space Defense System	199	278	226	13.6
AWACS Developments	119	137	118	-0.8
Space Boosters	216	139	118	-45.4
Satellite Control Facility RDT & E	71	92	115	62.0
Defense Support Program	78	138	95	21.8
Tactical Protective Systems	44	95	95	115.9
WWMCCS Info. Sys'tms Joint Prog.Off.	62	111	86	38.7
National Aerospace Plane Tech.	---	33	86	---

MAJOR DEFENSE DEPARTMENT PROGRAMS (CONTINUED)

- 60 -

	<u>FY 1986</u>	<u>FY 1987</u>	<u>FY 1988</u>	<u>% Growth 1986-88</u>
Avionics Tech.	71	68	78	9.9
Missile Range Improvements	53	65	74	39.6
Aircraft Protective Systems	50	93	72	44.0
Industrial Preparedness	63	84	69	9.5
Special Operations Forces	10	67	68	100+
Consolidated Space Center	85	94	67	-21.2
Flight Simulators Div.	128	103	62	-51.6
Aircraft Support RDT & E	55	62	61	10.9
Defense Meteorological Satellite	55	64	61	10.9
Materials Tech.	53	57	60	13.2
Minimum Essential Emergency Commun. Network	100	93	58	-42.0
Navstar GPS User Equip.	28	45	53	91.4
Electro-Optical Warfare Tech.	14	53	50	100+

THE PRICE SITUATION

Producer prices of switches overall are estimated by **Marketdata** to rise by 1.4% in 1986, continuing a deceleration of price increases since 1984. In 1984, prices rose by 6.4% and in 1985 by 2.8%. Competitive market pressures, foreign competition, plus the absence of any significant contributing factors such as materials shortages will keep a lid on prices for the near future.

This 1.4% increase for the total switches market will be lower than the estimated 2.2% rise for "All Electronic Components and Accessories" (SIC code 367). Prices of **Rotary** switches rose 3.4% in 1985 and **Pushbutton** types were up 2.6%. However, during 1986 these increases are expected to moderate to 0.5% and 0.4% respectively.

The following page illustrates producer price trends from 1983 through September 1986 (latest data available), by type switch. Data was obtained from the Bureau of Labor Statistics (monthly Producer Price Indexes).

TRENDS IN PRODUCER PRICE INDEXES FOR SWITCHES

(Not Seasonally Adjusted)

June 1982=100 Index Base Year

	ALL MECHANICAL SWITCHES (for electronic applic.)	ROTARY (excl. thumbwheel type)	OTHER: DIP, Snap-action, Thumbwheel		
			KEYBOARD	PUSHBUTTON	Other
ANNUAL AVG.					
1983	102.9	93.2	NA	106.8	NA
1984	109.5	93	NA	109.6	NA
1985	112.6	96.2	NA	112.5	NA
1986 By Month:					
JANUARY	112.5	95.2	110.4	112.9	117.7
FEBRUARY	113.7	95.2	110.4	112.9	120.4
MARCH	114	96.7	110.4	112.9	120.4
APRIL	113.9	96.7	110.4	112.9	120.4
MAY	114	96.7	110.4	112.9	120.4
JUNE	113.9	96.7	110.4	112.2	120.4
JULY	113.9	96.7	110.4	112.2	120.4
AUGUST	113.9	96.7	110.4	112.2	120.4
SEPTEMBER	113.9	96.7	110.4	112.2	120.4

NA-Data Not Available

THE EXPORT MARKET

After strong growth during 1984, the export market for U.S. switches seems to have levelled off at the \$85 million mark. The market was stuck at \$70-75 million yearly, until the value of U.S. exports shot up almost 26% to \$96.7 million in 1984. Volume was down 9.5% in 1985, and based on January-October 1986 monthly activity should fall roughly 5% to \$83 million by year-end 1986. This should equal 13.8% of domestic sales.

Historically (1980-85), **snap-action** switches have accounted for the bulk of exports dollar volume--54%, compared to 22% each for **pushbutton** and **rotary** types. For 1986, **Marketdata** estimates that snap-action switch exports will account for 60% of the overseas market (worth \$50 million), pushbutton devices 20.6% (or \$17 million), and rotary switches 19.5% (or \$16 million).

In the pushbutton switch category, dollar exports seem to be fairly evenly divided between "under 5 amp" and "over 5 amp" devices. For rotary types, about two-thirds of volume is in the "under 5 amp" range, one-third "over 5 amps".

According to the 1984 Mackintosh Yearbook, following is a breakdown of several **European** switch markets, in terms of these nations' production, market size, and "shortfall" (that which must be made up by imported devices). Based on this data, the countries with the greatest opportunities for export penetration would appear to be **Norway** and **Sweden**.

1984 EUROPEAN SWITCH PRODUCTION & MARKET

(Ranked in Order of "Shortfall"-Deficit Not Served by Domestic Production)

(\$ Millions)

	<u>Production</u>	<u>Market Size</u>	<u>Shortfall</u>
Norway	\$6	\$32	\$26
Sweden	8	32	24
Belgium	8	23	15
Netherlands	20	34	14
Italy	30	43	13
France	65	77	12

TABLE CONTINUED

Spain	10	20	10
United Kingdom	91	100	9
Finland	11	20	9
Denmark	2	10	8
Switzerland	11	13	2
W. Germany	78	70	(8)

The largest European market in terms of absolute size is located in England. West Germany, having an oversupply of production (exceeding market size) of \$8 million would not appear to be a good target country for U.S. switch exporters. A more up-to-date analysis of 1985 switch exports by country of destination appears in this section.

TOTAL SWITCHES EXPORTS RELATIVE TO DOMESTIC SALES
 (\$ Millions)

	EXPORTS	ANNUAL % CHANGE	EXPORTS AS % U.S. SALES
1980	70.6	--	19.2
1981	74.3	5.2	19.7
1982	75.6	1.7	16.9
1983	76.8	1.6	15
1984	96.7	25.9	18
1985	87.5	-9.5	--
1986 Estim.*	83.2	-4.9	

* Marketdata Estimate, based on data from Jan. - Oct. 1986

SOURCE: U.S. DEPARTMENT OF COMMERCE, PERCENT CALCULATIO

U.S. PRODUCERS' EXPORTS OF SWITCHES, BY KIND

(\$ Millions)

	<u>SNAP-ACTION</u>	<u>PUSHBUTTON (not over 5 amp)</u>	<u>PUSHBUTTON (over 5 amp)</u>	<u>ROTARY (over 5 amp)</u>	<u>ROTARY (over 5 amp)</u>
1980	35.9	9.8	9.3	10.8	4.8
1981	36.1	9.3	9.5	14.3	5.1
1982	40.7	8.1	8.3	14.4	4.1
1983	42.9	7.8	7.8	14.4	3.9
1984	53.4	10.8	8.9	19.1	4.5
1985	50.6	8	10.1	15	3.8
1986 Est.*	49.9*	9.1*	8.0*	11.4*	4.8*

*Marketdata Estimate, based on exports data from Jan. - Oct. 1986.

SOURCE: U.S. DEPARTMENT OF COMMERCE, SCHEDULE B-COMMODITY BY COUNTRY

**SWITCHES EXPORTS BY TYPE
PRODUCT LINE MIX - PERCENT DISTRIBUTION**

PERCENT OF TOTAL EXPORT SALES

	<u>SNAP ACTION</u>	<u>PUSHBUTTON</u>	<u>ROTARY</u>
1980	50.8	27.1	22.1
1981	48.6	25.3	19.4
1982	53.8	21.7	24.5
1983	55.9	20.3	23.8
1984	55.2	20.4	24.4
1985	57.8	20.7	21.5
1986 Estim.*	60	20.6	19.5
Avg. For 1980-8	54.6	22.3	22.2

* Marketdata Estimate, based on data for Jan. - Oct. 1986.

**SOURCE: U.S. DEPT. OF COMMERCE, CALCULATIONS,
ESTIMATES BY MARKETDATA**

**U. S. EXPORTS BY TYPE SWITCH
BY COUNTRY OF DESTINATION
1985**

PERCENT OF VALUE OF EXPORTS

ROTARY (Not Over 5A)		ROTARY (Over 5A)	
		(\$ million)	
TOTAL VALUE-\$	14.96		3.81
Canada	33.8	Canada	47.5
U. Kingdom	10.4	Japan	8
Japan	7.5	W.Germany	5.1
W.Germany	6.9	Belgium	5
Mexico	5.6	Mexico	5
Korean Rep.	4.4	Cumul.Total	70.6
Cumul.Total	68.6		

PUSHBUTTON (NOT OVER 5A)		PUSHBUTTON (OVER 5A)	
TOTAL VALUE-\$	8.04		10.12
W.Germany	18.8	Canada	27.3
Canada	17.5	U.Kingdom	14.3
U.Kingdom	16.5	Spain	9.7
Japan	7	Japan	8.2
Haiti	5.5	Italy	6.3
Cumul.Total	65.3	Cumul.Total	65.8

SNAP-ACTION

TOTAL VALUE-\$	50.76
Canada	17.2
U.Kingdom	16.5
Netherlands	13
Mexico	10
Japan	8.3
W.Germany	8.3
Cumul.Total	73.3

IMPORT COMPETITION: PENETRATION BY OVERSEAS PRODUCERS

Imports of switches (without automatic tripping mechanisms) rose 2% to \$85.2 million during 1985. This figure is based on the "customs, insurance, and freight-in" value by the Commerce Department. Back in 1981, import penetration represented over 20% of the domestic market, but the value of imported switches has risen only moderately since then, and are estimated to be equal to 15.3% of U.S. sales in 1985.

As of 1985, **SNAP-ACTION** devices accounted for 45% of imports' dollar volume, followed by **PUSHBUTTON** switches at 43% and **ROTARY** switches with 11%. In dollar value, this equals \$38.9 million--snap-action, \$36.7 million --pushbutton, and \$9.5 million--rotary switches. In this section is a table covering the countries of origin of these imports, by type switch.

As in numerous other industries, the Japanese are an increasing factor. Japan's dual-in-line package (DIP) switch makers' target was recently cited as to reduce prices to the 4-cent-a-pin level in order to be competitive in the U.S.--to compete by volume with AMP, CTS and Grayhill (which are estimated to capture 75% of the U.S. DIP switch market).

Fujisoku, a full-line switch maker, said that Japan's DIP switch exports to the U.S. may amount to 20% of local consumption, or about \$8 million as of 1985. **Alps Electric Co., Ltd.** is Japan's largest parts and components supplier, and is also active in the market. **New Noto Co. Ltd.** in 1985 was exporting 600,000 units per month to its U.S. OEM company **Alco**.

Slide type DIP switches are also highlighted for export to the U.S. **Copal Electronics** specializes in rotary type DIP switches in Japan, and the firm is targeted at *new* users who have not used slide switches in the past. Japanese DIP switch makers all point to printers and other computer peripherals as the key users of their switches, as well as telephone equipment.

As Japan's office equipment industry showed significant growth in recent years, so has the DIP switch industry. Large segments of Japanese office equipment are exported to this country, which have DIP switches incorporated in the equipment.

UNITED STATES IMPORTS OF ELECTRONIC SWITCHES
(Without Automatic Tripping Mechanisms)

	Total	Annual %	Imports As %
	Imports**	Change	Domestic Sales
	(\$ Millions)		
1981	78.2	—	20.7
1982	72.8	-6.9	16.3
1983	77.3	6.1	15.1
1984	83.4	8	15.6
1985	85.2	2.1	15.3 *

* Estimated by Marketdata ** Value includes: Customs, Insurance & Freight.

PERCENT DISTRIBUTION OF IMPORTS, BY TYPE SWITCH
Percent of Dollar Value of Total Switch Imports

	ROTARY	PUSHBUTTON	SNAP-ACTION
1981	12.9	38.8	48.3
1982	15.7	43.9	40.4
1983	13.2	44.7	42.1
1984	12.3	41	46.7
1985	11.2	43.1	45.7

VALUE OF UNITED STATES IMPORTS OF SWITCHES
(Without Automatic Tripping Mechanisms)

(\$ Millions-Includes: Customs, Insurance & Freight)

	ROTARY	PUSHBUTTON	SNAP-ACTION
1981	10.1	30.3	37.8
1982	11.4	31.9	29.4
1983	10.2	34.5	32.5
1984	10.3	34.2	38.9
1985	9.5	36.7	38.9

**SOURCE: U.S. DEPARTMENT OF COMMERCE, CALCULATIONS BY
MARKETDATA**

**U.S. IMPORTS BY TYPE SWITCH
BY COUNTRY OF ORIGIN
1985**

PERCENT OF VALUE OF IMPORTS

ROTARY SWITCHES PUSH-BUTTON SWITCHES SNAP-ACTION SWITCHES

(Acting type, without auto. tripping mech.)

(\$ Millions-Incl. Customs, Insurance, Freight)

TOTAL VALUE-\$	9.54	36.71	38.94
Japan	31.7	31.8	18
Mexico	28.5	21	67.4
W. Germany	17.1	6.5	2.4
United Kingdom	3.4	6.6	3.5
Malaysia	---	12.6	---
China(Taiwan)	---	3.2	4.6
Cumul.Total:	80.7	81.7	95.9

SWITCH COMPANY PROFILES

AMP, INC.

Amp Inc. is a leading producer of electrical connection, switching, and programming devices and the application tools and machines to attach these devices to wires, cables, or printed circuitry. The main products are solderless terminals, splices, multiple connectors, coaxial connectors, packaging and interconnection devices, switches, and programming systems--accounting for about 95% of sales. As an integral part of its business, AMP provides extensive engineering services for its customers.

Between 80% and 90% of AMP's sales are to electronics-oriented markets. An approximate breakdown of worldwide sales by major market categories is computer and office-30%, transportation and electrical-20%, communications-15%, consumer goods-10%, special industries-10%, and aerospace and military-5%.

Foreign operations accounted for 43% of sales and 67% of net income in 1985. Research, development and engineering expenditures totaled \$160 million (9.8% of sales) in 1985, versus \$163 million (9.0%) in 1984.

Revenues for 1986 are projected to rise about 17%, reflecting benefits from the weaker dollar (foreign sales accounted for 43% of revenues in 1985) and a continuing upturn in the domestic electronics market. While foreign sales should experience modest growth in terms of local currencies, there will be a substantial positive benefit to revenues upon translating those sales into dollars.

AMP's U.S. margins are still not as good as they could be. The company has reduced costs, primarily direct labor, but only 65% of its capacity was recently being utilized. AMP is suffering because its major customer, IBM, has experienced a setback in the personal computer market, as well as the slower-than-anticipated acceptance of new models among the larger machines. Also, weak telecommunications markets with no expected improvement over 1985 don't help. It is expected that second half 1986 performance will not match the first in areas such as the firm's industrial and commercial divisions. If business weakness continues, latent pricing pressures may once again rise, damaging margins more.

Following is a financial summary of the company from 1980-85.....

Year Ended Dec. 31	Sales	Net Profit Before Taxes	Net As % Sales	Capital Expend.
(Million \$)				
1985	\$1,636	\$193	6.6%	\$198
1984	1,813	363	11.1	256
1983	1,515	293	10.8	128
1982	1,243	214	9.6	122
1981	1,234	241	10.9	109
1980	1,155	231	11.4	113

COMPANY PROFILES (CONTINUED)

AUGAT, INC.

Augat is a leading manufacturer of a broad range of electromechanical components (especially integrated circuit connectors) for the electronics industry. Products include interconnection components (sockets, switches, flat cable products) for 39% of sales, microcircuit packaging (10%), customized connectors (22%), CATV connectors (11%), interconnection systems and test equipment (18%). Foreign sales account for 17% of the total, and the firm employs 3,800 workers.

Augat also has a relatively small exposure to international business, compared to other connector producers. Income per share has essentially gone nowhere during the 1980s and margins are still tight, according to major financial investment analysts. Capacity utilization is cited as getting better, but is still poor at between 60 and 70% on average. This situation is probably unlikely to change significantly in the near future.

Through the 1979 acquisitions of LRC Electronics, Inc., a producer of connectors for the cable TV industry, and Vitek Electronics, Inc., which makes cable TV security devices, Augat has become a leading supplier of components to the cable TV business.

Following is a financial summary of the company from 1980-86 Est.....

Year Ended Dec 31	Sales	Net Profit Before Taxes	Net As % Sales	Capital Expend.	Current Ratio
(million \$)					
1986Est. *	\$265	\$12.0	4.5%	---	---
1985	255	12.1	4.7	\$24.7	4.4
1984	257.1	24.1	9.4	23.0	4.5
1983	202.4	23.5	11.6	14.0	4.6
1982	188.3	20.2	10.8	11.9	5.5
1981	173.9	20.1	11.6	16.1	5.9
1980	157.3	18.0	11.5	16.2	4.9

*Estimated by Value Line.

C T S CORPORATION

CTS Corporation makes electronic components and subsystems for original equipment manufacturers. Its principal products include: PC boards, resistor networks, hybrid microcircuits, auto engine controls, variable resistors, connectors, memory subsystems, and programmable switches. Major end-use markets include computer, communications, automotive, instrumentation, and medical products industries. CTS employs 7,009 workers.

Earlier in 1986 Dynamics Corp. of America (DCA) increased its holdings in CTS to 27.5% of the issue by asking for and receiving tenders for one million shares at \$43 each. It then proposed its own slate of directors who solicited proxies for control of the CTS Board. However, that effort was in vain. DCA did not quit; it is suing to overturn election results of CTS' incumbent board members (May 16 election).

CTS hopes to keep DCA in check with a "poison pill" defense. Management has instituted a rights program to "protect" shareholders in the event CTS becomes the target for a hostile takeover try. Under the plan, each share has received one right, which would require CTS to issue a \$50 one-year note at 10%. The result could be an uncomfortable debt burden for CTS, but the rights plan doesn't preclude the firm from attracting a friendly offer.

CTS has been losing money lately because of the steep downturn in orders for components and subsystems. Also, margins have been squeezed from heavy new plant investment. Sales for the three months ended March 30, 1986 were down 19% year to year. A pre-tax loss of \$1,477,000 was incurred. Following is a financial summary of CTS from 1980-86.....

Year Ended Dec. 31	Sales	Net Profit Bef. Taxes (\$ Millions)	Net As % Sales	Capital Expend.	Current Ratio
1986 Est.	\$225	\$(4.0)	NM	----	----
1985	261.6	7.8	3.0	34.2	2.6
1984	327.2	25.0	7.7	28.5	2.4
1983	306.2	9.2	3.0	16.7	2.0
1982	223.4	6.6	3.0	11.7	2.6
1981	209.6	13.1	6.3	8.3	3.7
1980	188.0	10.3	5.5	10.2	4.4

NM-Not meaningful *Estimated by Value Line

COMPANY PROFILES (CONTINUED)

CHERRY ELECTRICAL PRODUCTS

Cherry, of Waukegan, IL, manufactures a full line of switches, including the following: keyboard, PC board, miniature & subminiature, military, membrane, momentary contact, safety switches, illuminated & non-illuminated pushbutton, lever, slide, snap-action, thumbwheel, and lighted display.

The firm is heavily involved in the troubled keyboards market, which has undergone a shake-out in the past year. It is estimated to capture 3.3% of the total switches market, worth about \$25 million, and Electronic News estimates that they capture 13% of the \$54.7 million keyboard switch market. In addition, EN estimates that Cherry has 11% of the \$12 million thumbwheel/snap-action switch market. With the competition and pressures of the keyboards market, Cherry decided to move completely offshore, moving full-travel keyboard production out of its Waukegan, IL plant to a wholly-owned subsidiary in Auerbach, West Germany (which is dedicated to keyboard production and is more heavily automated). One thing which may have helped the company is that it sells a lot of keyboards and keyswitches in the Far East.

The company will concentrate on improving its subminiature models, especially those utilized in automotive applications. President Peter Cherry feels that a permanent change has taken place in the industry, with the problem being that the firm's customers have gone overseas, coupled with the collapse in 1984-85 of the personal computer market. On a more current note, however, toward the end of 1986 **Marketdata** feels that the PC market firmed up substantially, induced by end-of-year Christmas season buying, and buying in anticipation of tax code revisions that would eliminate sales tax deductions on such high-ticket items.

COMPANY PROFILES (CONTINUED)

HUBBELL, Inc. (formerly named Harvey Hubbell)

Harvey Hubbell, Inc. makes electrical equipment for commercial, industrial, and utility customers. Foreign operations (in Canada and England) account for approximately 5% of sales and 3% of operating income. The company employs 5,766 workers.

Hubbell, Inc. has announced that it will acquire the Bell division of Square D, with annual sales recently estimated at \$14-15 million. Bell's weatherproof electrical boxes complement the products of Hubbell's Raco subsidiary.

Hubbell has had continuing success in improving the returns of its acquisitions. However, price competition is reducing the normally wide margins typical in the low voltage group.

The company's tax benefits for manufacturing in Puerto Rico appear fairly secure. Hubbell is expanding operations there to reduce its income tax rate, and should retain most of the tax forgiveness under the new tax legislation.

The firm's string of consecutive earnings gains, stretching back to 1974, goes hand-in-hand with its high marks for earnings predictability. Following is a financial summary of Hubbell from 1980-85.....

<u>Year Ended</u> <u>Dec. 31</u>	<u>Sales</u> (\$ Millions)	<u>Net Profit</u> <u>Bef. Taxes</u>	<u>Net As %</u> <u>Sales</u>	<u>Earnings</u> <u>Per Share</u>
1986 Est. *	\$ 570	\$55.0	9.3%	\$2.10
1985	521.1	47.7	9.2	1.91
1984	467.1	42.0	9.0	1.69
1983	422.4	37.2	8.8	1.50
1982	418.9	35.1	8.4	1.43
1981	445.8	34.6	7.8	1.41
1980	406.0	29.9	7.4	1.22

*Estimated by Value Line

M/A - COM, Inc.

M/A COM (formerly Microwave Associates) is a major supplier of equipment and systems for commercial telecommunications and defense applications, a leading supplier of digital information processing and transmission equipment, and a manufacturer of microwave components. Contributions by business segment in fiscal 1985 were:

Components	37% of SALES	49% of PROFITS
Cable/home commun.	28	27
Digital/commun.	35	24

Direct and indirect sales to U.S. Government agencies accounted for 35% of total sales in fiscal, 1985 (34% in fiscal 1984). Component products include semiconductor devices, circuits, assemblies, subsystems and related components for microwave and fiber optic systems. Customers include suppliers of military radar, missile guidance systems and navigation equipment, as well as makers of broadcast, CATV, and other communications equipment.

The cable/home communications segment is the largest U.S. producer of coaxial cable for the CATV industry, and makes microwave transmission systems and satellite earth stations. The integrated digital communications division makes a wide variety of equipment for communications transmission and switching applications, and office automation and information service systems.

Sales for the six months ended March 29, 1986 rose 3.6% year to year, with a \$38.9 million net loss, mainly due to restructuring charges. Sales should rise in fiscal 1986's second half, reflecting backlogs and order rates. As of April 1986 new orders for the 2nd quarter rose 10% over last year, to \$234.9 million, and the firm's backlog at March 29 was \$579.6 million, up 22%.

M/A COM stated that industry dynamics were such that it was not meeting earnings objectives. Problems cited were softness or slower-than-anticipated development in some markets and the high level of R & D required for emerging businesses. The firm was planning to refocus resources and streamline operations.

Following is a financial summary of the company from 1980-85.....

See next page.....

M/A COM, Inc. (Continued)

Year Ended Sept. 30	Sales	Net Prof. Bef. Taxes	Net As % Sales	Capital Expend.	Current Ratio
(\$ Millions)					
1985	\$844	\$60.4	4.9	\$81.3	3.6
1984	768	57.0	5.0	83.0	3.3
1983	637	50.4	4.9	85.1	3.5
1982	588	68.2	7.0	88.4	3.0
1981	515	70.0	7.9	72.8	3.4
1980	322	43.8	7.7	36.4	1.9

MICROSWITCH (DIV. HONEYWELL)

Exact sales figures for Honeywell's Microswitch division are not known, since Microswitch is not a separate, publicly-owned firm. However, **Marketdata** estimates that it is the market leader, with sales of about \$79 million--10.5% of the total market. This is based on its "share of production worker employment" in "miscellaneous electronic components" (SIC code 3679), plus the opinions of other industry analysts and trade journals. In 1982, according to the Marketing Economics Institute, its share was 6.5% of this manufacturing sector's employment, or 3,000 employees. We estimate that this share has risen since 1982.

At its Freeport, IL plant it makes the following switches: keyboard, miniature/subminiature, printed circuit, illuminated and nonilluminated pushbutton, rocker, rotary, snap-action and thumbwheel devices.

Electronic News (EN) estimates that Microswitch captures 27% of the \$54.7 million keyboard switch market. Honeywell is committed to the keyboard business, according to management, and Microswitch is also packaging keyboards with "mice" accessories, digitizing pads, and card readers purchased from other sources.

EN, in a February 10, 1986 article analyzing keyboards and switches, reported Microswitch as saying that it claimed to come through 1985 without much difficulty, in contrast to other switch companies. Its Marketing Director stated: "I doubt if the majority of our lines were off more than 10% for us (sensors and basic switches).....price erosion was in the low single-digit area--not terribly alarming.....We invested heavily in automation to help us keep our market position and to enable us to become a lowest-cost producer". This is a new approach for Microswitch.

COMPANY PROFILES (CONTINUED)

MOLEX, Inc.

Molex is a leading international supplier of connectors, cable, terminals, interconnection products and switches. The firm sells to manufacturers of a variety of electrical devices (business machines, stereos, home appliances, etc.). It operates six plants in the U.S. and eleven abroad. 1985 sales by geographic area were: U.S.-43%, Europe-13%, Far East-40%, other-4%. Labor costs run about 29% of sales and R & D 7%. The company employs 4,163 workers.

Molex's business remains on an uptrend. The 1986 fiscal year (ended 6/30) wound up with the firm's best quarter since 1984 and backlogs stood at \$66 million. The weakening dollar continues to benefit Molex results as well; more than 50% of the company's business is overseas sales. Even discounting currency considerations, Molex is doing well internationally, and the overseas workforce has grown. However, there is still room for improvement, as capacity utilization is still at only 65-70%.

Molex is maintaining its competitive position. Its margins have not eroded as badly as other competitors, and aggressive moves in the Far East have been keeping it ahead, even during the downturn, in opening new areas for production and sales. Its commitment to strong R & D remains one of the best in the business. The new tax code should not have much of an effect on Molex. Following is a financial summary of Molex from 1980-86.....

Year Ended Dec. 31	Sales	Net Profit Bef. Taxes	Net As % Sales
	(\$ Millions)		
1986 Est.*	\$285	\$32.0	11.2
1985	253.2	30.9	12.2
1984	252.2	38.2	15.2
1983	176.0	22.0	12.5
1982	165.8	20.7	12.5
1981	143.0	16.0	11.2
1980	121.5	14.8	12.2

*Estimated by Value Line.

OAK INDUSTRIES

Oak Industries, Inc. makes electronic components and communications equipment. Component products include: quartz crystals, switches, and controls for gas and electric ranges. The company also makes CATV terminal equipment. In 1985 Oak discontinued its over-the-air-pay-TV service in Los Angeles and Chicago. 1985 sales were divided as follows: components and controls-41%, materials (discontinued 1986)-46%, communications-13%. The firm employs 5,286 workers and allocates about 5% of sales to R & D investment.

Recently, Oak has been trying to manage a heavy debt burden, in the face of big operating losses. This year the firm made a deal for its most salable business and got holders of most of this debt to accept discounted repayments in cash and stock. In May it sold its electronic materials division to Allied-Signal for \$152 million in cash, most of which has gone to retiring \$186 million of debt. But, Oak, while not as strained, is not yet in the clear.

The company still has its cable TV equipment business, a segment that is losing money in a weak market. Due to its earlier production problems, competition has eroded market share. Oak will probably sell this business, bringing in \$15-20 million, to support the firm's ongoing electronic components business and to retire more debt. Thus, it should survive as a small component producer. The company should benefit by tax reform and reduced rates, but earnings probably will not recover until the 1989-91 period.

Following is a financial summary of Oak from 1980-86.....

Year Ended Dec. 31	Sales	Net Profit Before Taxes (\$ Millions)	Net As % Sales	Capital Expend.	Current Ratio
1986 Est.*	\$155	\$(35.0)	NM	---	---
1985	284.3	(37.6)	NM	---	---
1984	333.2	(95.5)	NM	\$17.3	1.5
1983	426.4	(166.1)	NM	22.2	1.8
1982	545.7	14.5	2.7	51.8	2.8
1981	507.1	30.4	6.0	89.1	1.7
1980	385.6	20.1	5.2	62.8	2.5

*Estimated by Value Line. NM-Not meaningful

COMPANY PROFILES (CONTINUED)

SQUARE D CO.

Square D Co. is a leading producer of electrical distribution and control products, including circuit breakers, safety switches, and relays. The firm also supplies electronic components, products and systems. Products are marketed to the construction industry, industrial customers, utilities and other manufacturers. Foreign markets account for 15% of total revenues and R & D costs represent 3.1% of sales. Square D employs about 21,500.

The firm's electrical equipment segment reported slightly higher earnings for the June 1986 quarter. The gain, however, resulted largely from advances in the utility products group and conceals weakness in several other product lines. Soft demand and intensified competition are hurting sales and margins in the electrical distribution, power, and control equipment lines. Nonresidential construction probably won't pick up until 1987, and these lines are likely to remain under pressure until then. Losses have declined in the electronics group because of cost reduction at Yates Industries (a copper foil manufacturer) and increased sales of programmable controllers.

Financial performance of the firm has worsened since Square D diversified into electronics in the early 1980s. Electronics offers above-average growth prospects; it also offers attractive synergies with Square D's traditional electrical equipment business. Still, it is not yet clear that the company will ever realize more than cyclically good results here.

Following is a financial summary of Square D from 1980-86.....

Year Ended		Net Profit	Net As %	Earnings
Dec. 31	<u>Sales</u>	<u>Bef. Taxes</u>	<u>Sales</u>	<u>Per Share</u>
	(\$ Millions)			
1986 Est.*	\$1,420	\$100	7.0%	\$3.50
1985	1,348.1	102.4	7.6	3.55
1984	1,365.5	106.2	7.8	3.71
1983	1,144.1	60.2	5.3	2.12
1982	1,057.0	71.7	6.8	2.61
1981	1,144.3	102.8	9.0	3.82
1980	999.0	83.0	8.3	3.41

*Estimated by Value Line.

SWITCH SUPPLIERS

KEY:

A = COAXIAL
B = KEYBOARD
C = MINIATURE/SUBMINIATURE
D = PRINTED CIRCUIT
E = PUSHBUTTON/ILLUMINATED
F = PUSHBUTTON/NONILLUMINATED

G = ROCKER
H = ROTARY
I = SLIDE
J = SNAP-ACTION
K = THUMBWHEEL
L = TOGGLE

=====

AC Interface Fuji Co. Ltd. 17911G Sampson Lane, Huntington Beach, CA 92647 [B]
AC Interface Inc. 17911G Sampson Lane, Huntington Beach, CA 92647 [B]
AD Data Systems Inc. 200G Commerce Dr., Rochester, NY 14623 [A]
AMP Distributor Mktg. Div. AMP Products Corp. Dept. G, PO Box 1776, Paoli, PA 19301
[C/D/I/H/K]
AMP Inc. Dept. G PO Box 3608, Harrisburg, PA 17105 [B/D/G/H/I/K]
AMP Products Corp. AMP Distributor Mktg. Div. Dept. G, PO Box 1776, Paoli, PA 19301 [B]
ARRA Inc. 15G Harold Ct., Bay Shore, NY 11706 [A]
ASM Corp. Dept. G PO Box 860, Smithfield, NC 27577 [C/H]
AVA Electronics Corp. 4000G Bridge St., Drexel Hill, PA 19026 [A]
Abbott Interfast Corp. Dept. G 190 Abbott Drive, Wheeling, IL 60090 [C/D]
Adams Russell Anzac Div. 80G Cambridge St., Burlington, MA 01803 [A]
Advanced Input Devices Dept. G, W 250 AID Dr., Coeur d'Alene, ID 83814 [B/E/F]
Aerospace Optics Inc. 3201 Sandy Lane, Fort Worth, TX 76112 [B/C/E]
Airflyte Electronics Dept. G, PO Box 231 Hook Rd., Bayonne, NJ 07002 [H]
Airlpax Corp. Cambridge Div., Dept. G Box 520 Woods Rd., Cambridge, MD 21613 [G/J/L]
Alaun Engineering 2350G Florencita Dr., Montrose, CA 91020 [A]
Alco Electronics Products Inc. 1551G Osgood St., N. Andover, MA 01845
[B/C/D/E/F/G/H/I/J/K/L]
Allen-Bradley Co. Electronics Div., Dept. G 1201 South 2nd St., Milwaukee, WI 53204
[E/F/H/J/L]
Alps Electric (USA) Inc. Dept. G 100 N. Centre Avenue, Rockville Centre, NY 11570
[B/C/D/E/F/G/H/I/J/L]
American Microwave Corp. 6835G Olney-Laytonville Rd., Gaithersburg, MD 20879 [A]
American Switch Corp. 134G Water St., Wakefield, MA 01880 [C/D/E/F/J/L]
Amphenol Products An Allied Co. 2122G York Road, Oak Brook, IL 60521 [A]
Arco Div. Blue Water Products Inc. 333G Strawberry Field Rd., Warwick, RI 02886 [C/J]
Arcoelectric Corp. Dept. G 9001 Canoga Ave., Canoga Park, CA 91304 [C/E/F/G/H/I/J/L]
Ark-Les Corp. 51G Water St., Watertown, MA 02172 [F/G/H/I/L]
Armtec Industries Bestobell Co. Dept. G, Manchester Municipal Airport, Manchester, NH 03103
[C/D/H/I/K/L]
Aromat Corp 250G Sheffield St., Mountainside, NJ 07092 [J]
Arrow Hart Div. Cooper Industries 103G Hawthorn Street, Hartford, CT 06101
[C/D/E/F/G/H/I/J/L]
Atlantic Microwave Corp. Dept. G, Rte. 117, Bolton, MA 01740 [A]
Augat Incorporated Components Div. 40G Perry Ave., Attleboro, MA 02703 [C/E/F/G/H/I/J/L]
Automatic Connector Inc. Dept. G, 400 Moreland Rd., Commack, NY 11725 [A]
Automatic Switch Co. 50-60G Hanover Rd., Florham Park, NJ 07932 [F]
Baco Controls Inc. 67G Albany St., Cazenovia, NY 13035 [C/E/F/H]
Barker & Williamson 10G Canal St., Bristol, PA 19007 [A]
Beckman Industrial Corp. Elec. Technologies Div. Dept. G, 2500 Harbor Blvd., MSC-33-E,
Fullerton, CA 92634 [H]
Bell Industries J.W. Miller Div. 19070G Reyes Ave., PO Box 5825, Compton, CA 90224 [A]
Berkshire Electronics Inc. Dept. G 3 N. Mill St., Hopkinton, MA 01748 [C/G/L]

Betatronix Inc. 110G Nikon Ct., Hauppauge, NY 11788 [H]
 Bird Electronic Corp. 30303G Aurora Rd., Cleveland, OH 44139 [A]
 WH Brady Co. Xymox Div. Dept. G, PO Box 571, Milwaukee, WI 53201 [B/F]
 Brake Mfg. 97G Madison Place, Ridgewood, NJ 07452 [G]
 Bryant Electric Westinghouse Electric Corp. 500G Sylvan Ave., Bridgeport, CT 06606 [G/L]
 Burgess Switch Co. Inc. Dept. G 638 Anthony Trail, PO Box 1186, Northbrook, IL 60062
 [C/F/J]
 C & K Components Inc. 15G Riverdale Ave., Newton, MA 02158 [C/D/E/F/G/H/I/J/K/L]
 C-E Invalco Combustion Engineering Inc. Dept. G, PO Box 556, Tulsa, OK 74101 [J]
 CTS Corp. Dept. G, 905 Northwest Blvd., Elkhart, IN 46514 [B/C/D/H/J]
 CTS Microelectronics Inc. 1201G Cumberland Ave., W. Lafayette, IN 47906 [H]
 CW Industries 130G Jamesway, Southampton, PA 18966 [C/D/G/H/I/J/L]
 Capitol Machine & Switch Co. 87G Newtown Rd., Danbury, CT 06810 [E/F]
 Carlingswitch Inc. Dept. G 505 New Park Ave., West Hartford, CT 06110 [C/D/F/G/H/I/J/L]
 Carlson Mfg. Co. Inc. Dept. G, PO Box 20464 5451 N. Rural St., Indianapolis, IN 46220 [H]
 Carter Mfg. Corp. 237G Sugar Rd., Bolton, MA 01740 [H]
 Centralab Inc. North American Phillips Dept. G, Hwy. 20 W, PO Box 858, Ft. Dodge, IA 50501
 [B/C/D/E/F/H/I]
 Centralab Inc. North American Phillips Dept. G, 5855 N. Glen Pk. Rd., Milwaukee, WI 53209
 [B]
 Channel Master Avnet Inc. Dept. G, Ellenville, NY 27577 [A]
 Cherry Electrical Products Corp. 3600G Sunset Ave., Waukegan, IL 60087 [B/D/E/F/I/J/K]
 Chicago Switch Inc. Illinois Tool Works Inc. Dept. G, 1714G North Damen Ave., Chicago, IL
 60647 [C/D/F/G/H/I/J]
 Cincinnati Electrosystems Inc. 469G Wards Corner Rd., Loveland, OH 45140 [K]
 Coaxial Dynamics Inc. 15210G Industrial Pkwy., Cleveland, OH 44135 [A]
 Cole Hersee Co. 20G Old Colony Ave., S. Boston, MA 02127 [F/G/H/I/J/K/L]
 Cole Instrument Corp. Dept. G 2650 S. Croddy Way, Santa Ana, CA 92704 [H]
 Collectron Corp. 80-02 51st Ave., Elmhurst, NY 11373 [H/I]
 Columbus Electric Mfg. Co. Dept. G Rt. 2, Box 289A, Piney Flats, TN 37686 [J]
 Communication Distribution Sys. Inc. 13141G San Fernando Rd., Sylmar, CA 91342 [A]
 Computer Cable & Products Inc. Affiliate Vertex Electronics 147G Gazza Blvd., Farmingdale,
 NY 11735 [A]
 Comus International 20G Baltimore St., Nutley, NJ 07110 [C]
 Conductive Rubber Technology 1235G Coast Village Rd., Santa Barbara, CA 93108 [B/E/F]
 Control Products Inc. 280G Ridgedale Ave., E. Hanover, NJ 07936 [F/J]
 Cool-Amp Conducto-Lube Co. Cool-Amp Div. Dept. G, 8603 SW 17th Ave., Portland, OR 97219
 [D/E]
 Corby Industries Inc. Dept. G, 2747 MacArthur Rd., Whitehall, PA 10852 [B]
 Crouse-Hinds Elec. Constr. Materials Div. Cooper Industries Inc. Dept. G, Box 4999, Syracuse,
 NY 13221 [E/F]
 Crouzet Controls Inc. 1083G State Pkwy., Schaumburg, IL 60109 [C/J/K]
 Current Industries Inc. 3359G Ocean Ave., Oceanside, NY 11572 [B]
 Cutler-Hammer Products Eaton Corp. Dept. G, 4201 N. 27th St., Milwaukee, WI 53216
 [E/F/H/L]
 DAI Ichi Shoji of America Dept. G 150 5th Ave. #516, New York, NY 10011 [C/D/E/F/G/L]
 DB Products Inc. Dept. G, 253 N. Vinedo Ave., Pasadena, CA 91107 [A]
 Daburn Electronics & Cable Corp. 70G Oak St., Norwood, NJ 07648 [I]
 Danavox Inc. Telecoms Div. 6400G Flying Cloud Dr., Minneapolis, MN 55344 [D]
 Dialight Corp. 203G Harrison Place, Brooklyn, NY 11237 [E/G/G/J/L]
 Dielectric Coms. Dept. G, Tower Road, Raymond, ME 04071 [A]
 Digitran Co. Dept. G 3100 New York Dr., Pasadena, CA 91107 [E/G/H/K]
 Dorman Bogdonoff Corp. Dept. G Willow Pond, Andover, MA 01810 [B/D]
 Dreefs Switch Inc. 3782G Hawthorne Ct., Waukegan, IL 60085 [C/D/F/G/H]
 E-H Electronics E-H International Inc. 48507 Milmont Dr., Freemont, CA 94538 [A]
 EAO Switch Corp. Dept. G, 198 Pepe's Farm Rd., Milford, CT 06460 [B/C/D/E/F/J]
 EECO Inc., EECO Ltd. Dept. G 1601 E. Chestnut Ave., PO Box 659, Santa Ana, CA 92702
 [C/D/E/H/K]

Eastern Microwave Corp. 4G Gill St., Woburn, MA 01801 [A]
 Eaton Corp. Microwave Components Div. Dept. G, 680 W. Maude Ave., Sunnyvale, CA 94086 [A]
 Edwards Co. Inc. General Signal Corp. 195G Farmington Ave., Farmington, CT 06032 [E/F]
 Electro Mech Components Inc. Dept. G 1826 N. Floradale Ave. S., El Monte, CA 91733 [D/E/F/J]
 Electro Standards Lab Inc. Dept. G, PO Box 9144, Providence, RI 02940 [A]
 Electro Switch Corp. 180G King Ave., Weymouth, MA 02188 [J/H]
 Electromagnetic Sciences Inc. 125G Technology Pk./Atlanta, Norcross, GA 30092 [A]
 Elmwood Sensors Inc. 500 Narragansett Park Dr., Pawtucket, RI 02861 [J]
 Entech Systems Inc. 15G Herman Dr., Simsbury, CT 06070 [B/C/F/I/J/L]
 Entrelec Div. Cogenel Inc. Dept. G, Two Ram Ridge Rd., Spring Valley, NY 10977 [E/F/H]
 Ercona Corp. 125G Wilbur Place, Bohemia, NY 11716 [E]
 Erni Components Corp. Dept. G 1235 E. Davis St., Arlington Heights, IL 60005 [C/D/K]
 FASCO Inds. Inc. Motor Div. Dept. G, 1301 W. Cermak Rd., Oak Brook, IL 60521 [J]
 Ferrite Components Inc. 10G Kidder Rd., Chelmsford, MA 01824 [A]
 Fifth Dimension Inc. 801G New York Ave., Trenton, NJ 08638 [A/D]
 Flex Key Corp. Rogers Corp. 18G Sargent St., Gloucester, MA 01930 [B/J]
 Force Electronics Dept. G 353 S. Hindry Ave., Inglewood, CA 90301 [I]
 Foster Engineering & Mfg. Inc. Dept. G, 2501 W. Behrend Dr., Phoenix, AZ 85027 [B]
 Frequency Electronics Inc. 55G Charles Lindbergh Blvd., Mitchel Field, NY 11553 [A]
 Furnas Elec. Co. 1000G McKee St., Batavia, IL 60510 [E/F]
 Futaba Corp. of America Dept. G 555 W. Victoria St., Compton, CA 90220 [B/D/F/I]
 GC Electronics Household Intl. Dept. G, 400 S. Wyman St., Rockford, IL 61101 [B/E/F/G/H/I/J/K/L]
 GTE Corp. Precision Metals Group 100G Endicott St., Danvers, MA 01923 [J]
 GTE Corp. GTE Network System Switching Dept. G, 400 N. Wolf Rd., Northlake, IL 60164 [H]
 GTE Sylvania Inc. Control Devices Dept. G, Rte. 35, Standish, ME 04084 [J]
 GTI Corp. Circuits Div. Dept. G, PO Box 217, Leesburg, IN 46538 [D]
 Gaynor Electric Co. Inc. Dept. G, 172 E. Aurora St. PO Box 2125, Waterbury, CT 06720 [F/I/L]
 General Microwave Corp. Dept. G, 155 Marine St., Farmingdale, NY 11735 [A]
 Ghielmetti Inc. 6290G Sunset Blvd., Ste. 1126, Los Angeles, CA 90028 [K]
 Claud S. Gordon Co. Dept. G PO Box 500, Richmond, IL 60071 [H]
 Gordos Corp. Dept. G 250 Glenwood Ave., Bloomfield, NJ 07003 [B/C]
 Grayhill Inc. 561G Hillgrove Ave., LaGrange, IL 60525 [B/C/D/E/F/G/H/J]
 Gulton Ind. Inc. Luminator Div. Dept. G, 1200 E. Plano Pkwy., Plano, TX 75074 [E/F]
 Hamilton Standard Controls United Technologies 100G Airport Dr., PO Box 11648, Ft. Wayne, IN 46859 [J]
 Haydon Switch & Instrument Inc. Dept. G PO Box 3329, 1500 Meriden Rd., Waterbury, CT 06705 [C/F/L]
 Heath Co. Dept. G, Benton Harbor, MI 49022 [A]
 Hermetic Switch Inc. Dept. G PO Box 1325, Hwy. 92 S., Chickasha, OK 73018 [C]
 Hewlett-Packard Co. 3000G Hanover St., Palo Alto, CA 94304 [A]
 Hirose Electric USA 9254G Deering Ave., Chatsworth, CA 91311 [A]
 Hugin Industries 745G Distel Dr., Los Altos, CA 94022 [I]
 IDEC Systems & Controls Corp. 3050G Tasman Dr., Santa Clara, CA 95050 [E/F/J/L]
 ITT Jennings 970G McLaughlin Ave., San Jose, CA 95122 [A]
 ITT Schadow Inc. 8081G Wallace Rd., Eden Prairie, MN 55344 [B/C/D/E/F/H/I/J]
 IVO Industries Inc. Dept. G, Drawer 917 201 Industrial Way, W. Eatontown, NJ 07724 [F]
 Illinois Tool Works Inc. Cortron Div. Dept. G, 400 W. Grand, Elmhurst, IL 60126 [B/C/D/E/F/G/H/I/J]
 Imtronics Industries Ltd. Dept. G 11930 31st Ct., St. Petersburg, FL 33702 [H/I]
 Industrial Elec. Engineers Inc. (IEE) 7740G Lamona Ave., Van Nuys, CA 91405 [B/E/L]
 Industrial Resource Svcs. 7343G NW 79th Terrace, Miami, FL 33166 [B]
 Info-Lite Corp. 422G Cliff St., Fairview, NJ 07022 [A]
 Inter-Market Inc. 1946G Lehigh Ave., Glenview, IL 60025 [K]

International Resource Svcs. 7343G NW 79th Terrace, Miami, FL 33166 [G/I/L]
 Interswitch 770G Airport Blvd, Burlingame, CA 94010 [K]
 Intra Computer Inc. Dept. G, 101 W. 31st St., New York, NY 10001 [A]
 JFW Industries Inc. Dept. G, 2719 E. Troy Ave., Indianapolis, IN 46203 [A]
 Janco Corp. 3111G Winona Ave, Box 3038, Burbank, CA 91504 [D/E/F/H]
 K & L Microwave Inc. 408G Coles Circle, Salisbury, MD 21801 [A/C]
 Kay Elemetrics Corp 12G Maple Ave., Pine Brook, NJ 07058 [C/L]
 Key Tronic Corp. Dept. G, PO Box 14687, Spokane, WA 99214 [B]
 Kilovac Corp. Dept. G, PO Box 4422, Santa Barbara, CA 93103 [A]
 Kings Electronics Co. Inc. 40G Marbledale Rd., Tuckahoe, NY 10707 [A]
 Klockner Moeller Corp. 4G Strathmore Rd., Natick, MA 01760 [H/J]
 Korry Electronics Co. 223G 8th Ave. N., Seattle, WA 98109 [B/E]
 Kulka-Smith Inc. Dept. G 1913 Atlantic Ave., Manasquan, NJ 08736 [I/L]
 LARS Microwave Component Div. 310 E. 46 St., Rm. 23H, New York, NY 10017 [A]
 LVC Ind. Inc. 23G Hanse Ave., Freeport, NY 11520 [I]
 Lamb Industries Inc. Dept. G, 8835 S.W. Canyon Lane Suite 313, PO Box 25110, Portland, OR 97225 [B/C/D/E/F/G/H/I/J/L]
 Landis & Gyr Inc. Industrial Products 4G Westchester Plaza, Elmsford, NY 10523 [C/F/J]
 Lectronic Research Labs Inc. 1423G Ferry Ave., Camden, NJ 08104 [A]
 Ledex Inc. 801G Scholz Dr., Vandalia, OH 45377 [E/F/H]
 Leecraft Mfg. Co. Inc. Dept. G 21-02 44th Rd., Long Island City, NY 11101 [I/L]
 Leeds & Northrup Instrus General Signal Corp. Dept. G, Sumneytown Pike, N. Wales, PA 19454 [H]
 Lewis Engineering Co. 238G Water St., Naugatuk, CT 06770 [H]
 Littelfuse Inc. Dept. G 800 E. Northwest Hwy., Des Plaines, IL 60016 [C/E/F/G/J/L]
 Litton Industries Inc. Poly Scientific Div. Dept. G, 1213 N. Main St., Blacksburg, VA 24060 [H]
 Lorch Electronics Corp. 105G Cedar Lane, Englewood, NJ 07631 [A]
 Lumenite Elec. Co. Dept. G 2331 N. 17th Ave., Franklin Park, IL 60131 [K]
 M/A-COM Microwave Circuits Inc. M/A-COM, Dept. G, 52 South Ave., Burlington, MA 01803 [A]
 M/A-COM Microwave Circuits Inc. Solid State Circuits Div. 6G Wentworth Ave., Hudson, NH 03051 [A]
 M/A-COM Microwave Components Inc M/A-COM, Dept. G, 52 South Ave., Burlington, MA 01803 [A]
 M/A-COM Millimeter Products Inc. Dept. G South Ave., Burlington, MA 01803 [A/C]
 MBD Microwave Dept. G, 60 W. Easy St., Simi Valley, CA 93065 [A]
 MEI 461G Carlisle Dr., Herndon, VA 22070 [B/E/F]
 MG Electronics Industrial Products 32G Ranick Rd., Hauppauge, NY 11788 [C/L]
 MSC Products/Eaton Corp. 1640G Monrovia Ave., Costa Mesa, CA 92627 [B/F/K]
 Machine Components Corp. 70G Newtown Rd., Plainview, NY 11803 [C/F/J/L]
 Mallory Distributor Products Co. Dept. G 3029 E. Washington St., Indianapolis, IN 46201 [H/I]
 Mantex Corp. 1800 Metamora Rd., PO Box 15G, Oxford, MI 48051 [B]
 March Electronics Inc. 143-145G Nassau Blvd., W. Hempstead, NY 11552 [E/H]
 Marlee Switch Co. Dept. G 933-D N. Central Ave., Upland, CA 91786 [H]
 Marquardt Switches Inc. Dept. G 67 Albany St., PO Box 465, Cazenovia, NY 13035 [B/D/E/F/G/I/J/L]
 Martin Sound Products Inc. Dept. G 28 Alpha Park, Cleveland, OH 44143 [F]
 Maurey Instrument Corp. Dept. G 4555 W. 60th St., Chicago, IL 60629 [H]
 Maxi-Switch Co. Dept. G, 9697 E. River Rd., Minneapolis, MN 55433 [B/E/F]
 McGill Mfg. Co. Inc. Electrical Div. Dept. G, 1002 N. Campbell St., Valparaiso, IN 46383 [C/F/G/J/L]
 Mechanical Enterprises Inc. 461G Carlisle Dr., Herndon, VA 22070 [B/E/F]
 Merit Component Supply Inc. Dept. G 1508 W. Burbank Blvd., Burbank, CA 91506 [E/F/H/K]
 Merrimac Industries Inc. 41G Fairfield Pl., W. Caldwell, NJ 07007 [A/D]
 Methode Electronics Inc. Dept. G 7444 W. Wilson Ave., Chicago, IL 60656 [D]
 Micro Coms Inc. 438G Kelley Ave. PO Box 4365, Manchester, NH 03108 [A]
 Micro Switch Honeywell Dept. G, 11 W. Spring St., Freeport, IL 61032 [B/C/D/E/F/G/H/J/L]

Microavionics Corp. Dept. G 3198 Airport Loop Dr. #K, Costa Mesa, CA 92626 [E/F/H]
 Micronetics Inc. 36G Oak St., Norwood, NJ 07648 [A]
 Microwave Development Labs Inc. 10G Michigan Dr., Natick, MA 01760 [H]
 Microwave Filter 6743G Kinne St., E. Syracuse, NY 13057 [A]
 Microwave Supply Center Cleland and Co. Inc. 5669G Selmaraine Dr., Culver City, CA 90230 [A]
 Microwave Techniques Inc. Dept. G, PO Box 97, Raymond, ME 04071 [A]
 Minelco Inc. Talley Industries Dept. G, 135 S. Main St., Thomaston, CT 06787 [D/H/I]
 Misco Inc. Computer Supplies Dept. G, One Misco Plaza, Holmdel, NJ 07733 [A]
 Molex Inc. 2222G Wellington Ct., Lisle, IL 60532 [D/E/F/G/J]
 Mouser Electronics 11433G Woodside Ave., Santee, CA 92071 [D/F/G/H/I/L]
 Mura Corp. Components & Distributor Products 177G Cantiguage Rock Rd., Westbury, NY 11590 [C/D/F/G/H/I/L]
 NKK Switches of America Inc. Dept. G 14415 N. Scottsdale Rd., Ste. 600, Scottsdale, AZ 85260 [C/D/E/F/G/H/L]
 National Electro-Sales Corp. 7110G Gerald Ave, Van Nuys, CA 91406 [B/F/G/H/I/J/L]
 Nexus Inc. 50G Sunnyside Ave., Stamford, CT 06904 [F/J]
 JM Ney Co. Electronics Div. Dept. G, Ney Industrial Park, Bloomfield, CT 06002 [H]
 Norsal Industries Inc. Dept. G, 85D Hoffman Lane S., Central Islip, NY 11722 [A]
 North Hills Electronics Inc. Dept. G, Alexander Place, Glen Cove, NY 11542 [A]
 Nutone Hsg. Group Scovill Inc. Dept. G, Madison & Red Bank Rds., Cincinnati, OH 45227 [E/F]
 Oak Switch Sys. Inc. Dept. G PO Box 517, Crystal Lake, IL 60014 [B/D/E/F/H/I]
 Ohmite Mfg. Co. 3601G Howard, Skokie, IL 60076 [H]
 Omron Electronics Inc. Dept. G One E. Commerce Dr., Schaumburg, IL 60195 [C/D/J/K]
 Oneida Electronics Mfg. Co. Inc. Dept. G PO Box 678, Meadville, PA 16335 [C/G/I/L]
 Ora Electronics Alliance Research Corp. 20120G Plummer St., Chatsworth, CA 91311 [E/F/L]
 Orbit Instrument Corp. 80G Cabot Ct., Hauppauge, NY 11787 [B/E/F]
 Orbit Instrument of California 6431G Global Dr., Cypress, CA 90630 [B/E/F]
 Oshino Electric Lamp Works Ltd. Dept. G, 2-5-2 Minami-Shinagawa Shinagawa-Ku, Tokyo, JAPAN [E]
 Oslo Controls Inc. 328G Industrial Ave., Cheshire, CT 06410 [E/F/G]
 Otto Controls Dept. G 2 E. Main St., Carpenterville, IL 60110 [C/D/F/J/L]
 P & H Labs Dept. G 4496 Runway St., PO Box 1900, Simi Valley, CA 93062 [A]
 PCK Elastomers Inc. 333G Byberry Rd., Hatboro, PA 19040 [D]
 PSI/Petrico Sls. Dept. G 10739 Tucker St., Ste. 100, Beltsville, MD 20705 [C]
 Paccom Dept. G 3928 148th NE, Redmond, WA 98052 [L]
 Pan American Trade Development Corp. 2G Park Ave., New York, NY 10016 [B/D/E/F/G/H/I/J/K/L]
 Panasonic Industrial Co. Industrial Group Dept. G, One Panasonic Way, Secaucus, NJ 07094 [B/F/G/H/I]
 Panel Components Corp. Dept. G PO Box 6626, Santa Rosa, CA 94506 [E]
 Patrick & Wilkins Co. 5100G Lancaster Ave., Philadelphia, PA 19131 [E/F/H/J]
 Peak Electronics Corp. PO 533 354-356G W. Lancaster Ave., Wayne, PA 19087 [C/D/F/G/I/J/K/L]
 Philmore Mfg. Co. Inc. 40G Inip Dr., Inwood, NY 11696 [A/C/F/L]
 Potter & Brumfield AMF 200G Richland Creek Dr., Princeton, IN 47671 [F/G/J]
 Power Controls Corp. Consumer Div. 1067G Bandera Rd., San Antonio, TX 78228 [J/L]
 Power Dynamics Inc. 177G Valley, S. Orange, NJ 07079 [C/D/G/H/I/J/L]
 Pres:Air:Trol Corp. 895G Mamaroneck Ave., Mamaroneck, NY 10543 [E/F]
 Presto-Matic Lock Co. Inc. 3048G Industrial 33rd St., Ft. Pierce, FL 33450 [F]
 Projects Unlimited Inc. 3680G Wyse Rd., Dayton, OH 45414 [C/F/H/L]
 Qualitrol Corp. 1385 Fairport Rd., Fairport, NY 14450 [J]
 RLC Electronics Inc. 83G Radio Circle, Mt. Kisco, NY 10549 [A]
 RYT Ind. Inc. 336G Mathew St., Santa Clara, CA 95050 [A]
 Racal-Dana Instruments Inc. 4G Goodyear, Irvine, CA 92714 [A]
 Radio Switch Corp. Dept. G 64 S. Main St., Marlboro, NJ 07746 [C/D/H]
 Refac Electronics Corp. Dept. G PO Box 809, Winsted, CT 06098 [B/F]

Relay Services Co. Dept. G 1310 N. Pulaski Rd., Chicago, IL 60651 [C/E/F/G/H/I/J/L]
 George Risk Industries Inc. Dept. G, GRI Plaza, Kimball, NE 69145 [B/D/E/F]
 Rogers Corp. Keyboard Div. Dept. G, Williams Field & Dobson Rd., Chandler, AZ 85224 [B]
 Rohde & Schwarz Sls. Co. Dept. G, 13 Nevada Dr., Lake Success, NY 11042 [A]
 Ross Engineering Corp. 559G Westchester Dr., Campbell, CA 95008 [A/H]
 Milton Ross Co. 511G Second St. Pike, Southampton, PA 18966 [D/F/J/L]
 SMK Electronics Corp. Dept. G 1901 Nancita, Palcentia, CA 92670 [B/D/F/G/I/J/K]
 SP America Inc. Shin-Etsu Polymer Co. 1181 N. Fourth St., San Jose, CA 95112 [B/G]
 Sage Labs Inc. 3G Huron Dr., Natick, MA 01760 [H/L]
 Samarius Inc. 300G Seymour Ave., Derby, CT 06418 [H]
 Satori Electric (America) Inc. Dept. G 23717 Hawthorne Blvd., Ste. 201, Torrance, CA 90505
 [C/D/F/G/H/L]
 Scanivalve Corp. Dept. G PO Box 20005, San Diego, CA 92120 [H]
 Schurter Inc. 1016G Clegg Ct., Petaluma, CA 94952 [B/C/D/E/F]
 Schwab-Koplin Assoc. Inc. Dept. G, 1768 SE Clearmont St. PO Box 5030, Port St. Lucie, FL
 33452 [B/C]
 Seacor Inc. Dept. G, Box 541 123 Woodland Ave., Westwood, NJ 07675 [B/C/D/E/F/I/K/L]
 Sector Motor Inds. Inc. 999G Grand Blvd., Deer Park, NY 11729 [A]
 Shallco Inc. Dept. G, PO Box 1089 Smithfield Industrial Park, Smithfield, NC 27577 [H]
 Sherry Assoc. Inc. 2942G Dow Ave., Tustin, CA 92680 [B/C/D/E/F/K]
 Shogyo Intl. Corp. 287G Northern Blvd., Great Neck, NY 11021 [I]
 Shokai Far East Ltd. Dept. EDG 280 N. Central Ave., Hartsdale, NY 10530
 [B/C/D/E/F/G/H/I/J/K/L]
 Siemens Components Inc. Special Products Div. 186G Wood Ave., S. Iselin, NJ 08830 [D]
 Signal Systems Intl. Dept. G PO Box 198, Holmdel, NJ 07733 [D]
 Sparkomatic Corp. Dept. G Routes 6 and 209, Milford, PA 18337 [F]
 Specialties Mfg. Co. Inc. Spemco Switches Dept. G, Box 386, St. Clair Shores, MI 48080
 [C/D/E/F/G/H/I/J/K/L]
 Spectrol Electronics Corp. Dept. G 17070 E. Gale Ave., City of Industry, CA 91745 [H]
 Spectrum Assoc. Inc. Dept. G 179 N. Broad St., PO Box 470, Millford, CT 06460 [C]
 Square D Co. Dept. G Executive Plaza, Palatine, IL 60067 [E/F/H/J]
 Stackpole Components Co. Dept. G PO Box 14466, Raleigh, NC 27620 [B/C/D/E/F/G/H/I/L]
 Staco Switch Inc. 1139G Baker St., Costa Mesa, CA 92626 [B/E/F]
 Stancor United Technologies Essex Controls 131G Godfrey, Logansport, IN 46947 [H]
 Standard Grigsby Inc. Gordos International Co. 920G Rathbone Ave., Aurora, IL 60507
 [B/C/D/H/I]
 Standex Electronics Standex International Corp. 4538G Camberwell Rd., Cincinnati, OH 45209
 [B]
 Subminiature Instrus Corp. 3147G Durahart St., Riverside, CA 92507 [H]
 Support Systems Intl. Corp. Cables & Accessories Dept. G, 150 S. Second St., Richmond, CA
 94804 [A]
 Swieco Inc. Dept. G 1518 E. Lancaster, Fort Worth, TX 76101 [L]
 Switchcraft Inc. Dept. G 5555 N. Elston Ave., Chicago, IL 60630 [B/D/E/F/G/H/J/K]
 T Bar Inc. Dept. G PO Box T141 Danbury Rd., Wilton, CT 06897 [D/F/L]
 TEC Inc. Components Div., Dept. G 2727 N. Fairview Ave., PO Box 5646, Tucson, AZ 85703
 [B/C/D/E/F/G/H/I/J/L]
 TRW Microwave Inc. 825G Stewart Dr., Sunnyvale, CA 94086 [A]
 Tech Labs Inc. Dept. G Bergen & Edsall Blvs., Palisades Park, NJ 07650 [D/H/I/K/L]
 Technology for Communications Intl. 1625G Stierlin Rd., Mountain View, CA 94043 [A]
 Tecknit Inc. 129G Dermody St., Cranford, NJ 07016 [B]
 Teledyne Microwave 1290G Terra Bella Ave., Mountain View, CA 94043 [A]
 Telemechanique Inc. Dept. G 2525 S. Clearbrook Dr., Arlington Heights, IL 60005 [E/F/H/J]
 Telonic/Berkeley Inc. PO Box 277, 2825G Laguna Canyon Rd., Laguna Beach, CA 92652 [A]
 Temtron Electronics Ltd. 15G Main St., East Rockaway, NY 11518 [A/L]
 Texas Instruments Inc. Keyboard Prods/Connector Sys. 34G Forest St., Attleboro, MA 02703
 [B/D/J]
 Thermo Electric Co. 109G 5th St., Saddle Brook, NJ 07662 [F/H]

Topflight Corp. Membrane Switch Div. Dept. G, PO Box 472, York, PA 17405 [D/J]
 Touch Activated Switch Arrays Inc. TASA Dept. G, 2360 Walsh Ave., Santa Clara, CA 95051
 [B/E/F]
 Tower Mfg. Corp. 25G Reservoir Ave., Providence, RI 02907 [F/H/I/J/K/L]
 Tradeline Inc. Dept. G, 747 Middle Neck Rd., Great Neck, NY 11024 [B/E/F/G]
 Transco Products Inc. Dept. G 4241 Glenco Ave., PO Box 9997, Marina del Rey, CA 90295 [A]
 Transicoll Inc. Dept. G, Trooper Rd., Worcester, PA 19490 [B/E/F/J]
 Transistor Electronics Dept. G, West Rd. PO Box 230, Bennington, VT 05201 [K]
 Triangle Microwave Inc. 60G Okner Pkwy., Livingston, NJ 07039 [A]
 Trompeter Electronics Inc. 8936G Comanche, Chatsworth, CA 91311 [A]
 Truco Inc. Dept. G Hopmeadow St., Simsbury, CT 06070 [F]
 US Controls Corp. Dept. G 16955 W. Ryerson Rd., New Berlin, WI 53151 [F]
 Unicorn Engineering Co. Membrane Keyboard Div. 6201G Harwood Ave., Oakland, CA 94618 [B]
 Unimax Switch Corp. Ives Rd. -G, Wallingford, CT 06492 [C/E/F/H/K/L]
 Universal Enterprises Inc. Component Div., Dept. G. 14270 NW Science Park Dr., Portland, OR
 97229 [G/H/I/L]
 Varian Assoc. Electron Device Group 611G Hansen Way, Palo Alto, CA 94303 [A]
 Vectronics Microwave Corp. 276G Lincoln Blvd., Middlesex, NJ 08846 [A]
 Veetronik Inc. Reach Electronics Inc. Dept. G, Box 480, Lexington, NE 68850 [B/D/E/F]
 Vertex Electronics Inc. 151G Schmitt Blvd., Farmingdale, NY 11735 [A]
 Vidaire Electronics Mfg. 150G Buffalo Ave., PO Box 788, Freeport, NY 11520 [C/F/J/L]
 Waldom Electronics Inc. Dept. G 4335 W. 69th St., Chicago, IL 60629 [D/E/F/H/J]
 Wamco Inc. Dept. G 1555A Coley River Circle, Fountain Valley, CA 92708 [E]
 Ward Leonard Electric Co. Inc. 32G South St., Mt. Vernon, NY 10550 [E/F]
 Waveline Inc. 160G Passaic Ave., Fairfield, NJ 07006 [A]
 Weinschel Engineering Co. Inc. 1G Weinschel Lane, Gaithersburg, MD 20877 [A]
 Westinghouse Electric Corp. Control Div., Dept. G PO Box 5715 Haywood Rd., Arden, NC
 28704 [E/F/J]
 Whitman Control Corp. Dept. G 435 Lake Ave., PO Box 1478, Bristol, CT 06010 [C]
 Wide Band Engineering Co. Inc. Dept. G, PO Box 21652, Phoenix, AZ 85036 [A]
 Workman Electronics Products Inc. Dept. G PO Box 3828, Sarasota, FL 33578 [F/I/L]
 World Products Inc. Dept. G PO Box 517, Sonoma, CA 95476 [D]